File No. 190785 **Committee Item No.** 1
Board Item No. ______

COMMITTEE/BOARD OF SUPERVISORS

AGENDA PACKET CONTENTS LIST

Committee: Government Audit and Oversight **Date:** Nov. 18, 2021
Board of Supervisors Meeting: **Date:** ______

Cmte Board

- ☐ ☐ **Legislative Digest**
- ☐ ☐ **Budget and Legislative Analyst Report**
- ☐ ☐ **Youth Commission Report**
- ☒ ☐ **Introduction Form**
- ☐ ☐ **Department/Agency Cover Letter and/or Report**
- ☐ ☐ **MOU**
- ☐ ☐ **Grant Information Form**
- ☐ ☐ **Grant Budget**
- ☐ ☐ **Subcontract Budget**
- ☐ ☐ **Contract/Agreement**
- ☐ ☐ **Form 126 – Ethics Commission**
- ☐ ☐ **Award Letter**
- ☐ ☐ **Application**
- ☒ ☐ **Public Correspondence**

OTHER

- ☒ ☐ AECOM Report – June 7, 2021
- ☒ ☐ EFWS Seawater Resupply Report – June 4, 2021
- ☒ ☐ SFPUC EFWS Presentation – January 21, 2021
- ☒ ☐ BLA Presentation – January 21, 2021
- ☒ ☐ BLA Report – December 2, 2020
- ☒ ☐ SFPUC EFWS Presentation – July 16, 2020
- ☒ ☐ SFPUC Report – June 25, 2020
- ☒ ☐ Reso. No. 484-19
- ☒ ☐ COB Letter – Transmitting Reso. No 422-19 – October 15, 2020
- ☒ ☐ SFPUC Presentation – September 19, 2019
- ☒ ☐ Mayor Consolidated Response - September 16, 2019
- ☒ ☐ SFPUC Response – September 11, 2019
- ☒ ☐ Fire Commission Response – September 12, 2019
- ☒ ☐ Civil Grand Jury Report – July 17, 2019
- ☒ ☐ COB Letter – July 24, 2019
- ☒ ☐ Response Matrices
- ☒ ☐ Transmittal Letters

Prepared by: John Carroll **Date:** Nov. 12, 2021
Prepared by: John Carroll **Date:** ______
Prepared by: John Carroll **Date:** ______

SPA RISK

Fire Following Earthquake Water Requirements Study

Prepared for the
San Francisco Public Utilities Commission
David Myerson, P.E., Project Manager

by

Charles Scawthorn, S.E., D.Eng.
SPA Risk LLC

Under subcontract to

AECOM
Craig Smith

7 June 2021


Credit: https://photos.shawnclover.com/Galleries/Fade-To-1906/

PO 3326 San Francisco CA 94119 USA • www.sparisk.com • +1-415-729-4939

SPA RISK

Fire Following Earthquake Water Requirements Study

Prepared for the
San Francisco Public Utilities Commission
David Myerson, P.E., Project Manager

by

Charles Scawthorn, S.E., D.Eng.
SPA Risk LLC

Under subcontract to

AECOM
Craig Smith, P.E., Project Manager

7 June 2021

PO 3326 San Francisco CA 94119 USA • www.sparisk.com • +1-415-729-4939

ABSTRACT

The purpose of this project has been the estimation of water required to suppress fires following a major earthquake affecting the city of San Francisco. This is required to determine if water supply sources and conveyance infrastructure meet the requirements for firefighting, or if additional sources and infrastructure are required. The model (SPA FFE) that has been employed to estimate the required water is the result of decades of research and development

Understanding that the water and fire services are co-equal members of the fire suppression team is crucial to the estimation of water requirements for fire suppression – one service complements the other in fire suppression. This co-dependence greatly affects the total demand on the water system – if a rapid and adequate fire department response is met with adequate readily available water at the fireground, the fire is relatively small and the total water demand modest. If the fire department response is delayed or water is a long time coming to the fireground, the fire rapidly grows to multi-alarm (or even multi-block) proportions, and the amount of required water is orders of magnitude greater. Thus, this analysis necessarily models the performance of both the fire and water service, as best we can estimate.

San Francisco has substantial assets at risk – the current population of about 880,000 is projected to grow by 2040 to more than 1.1 million, with an associated aggregate current structure and contents replacement value of about $530 billion that will grow by 2040 to perhaps $665 billion, in current dollars.

These assets are threatened by earthquakes and the fires that will follow. Two scenario earthquakes have been analyzed: (1) a Mw 7.9 event on the San Andreas fault like the 1906 event, and (2) a Mw 7 event on the Hayward fault in the East Bay, either of which will cause very strong ground motions in San Francisco. The Mw 7.9 San Andreas event is generally the more damaging event especially in the western portions of the City, which are only a few miles from the fault. The Hayward event is considered more likely to occur in the near future.

The San Francisco Fire Department (SFFD) will be challenged by a major earthquake – the Mw 7.9 San Andreas event will likely generate on average about 130 fires in the first 24 hours under current conditions (with growth increasing to perhaps 160 fires by 2050) – with mutual aid probably taking many hours to arrive. Lacking adequate water leads to continued fire growth and a larger demand for firefighting water than at first arrival, which has been considered in the analysis.

Results of the analysis of 21 Cases for current and future variations in EFWS and SFFD improvements shows that effective firefighting under current conditions is estimated to require flows of about 140,000 gpm (median, 75th percentile is 200,000+ gpm) after the first few hours, equivalent to a total volume of about 200+ million gallons in the first 24 hours after an earthquake. Results for various Cases show that future water requirements can remain about the same, or be much larger, depending on the improvements made to the EFWS and SFFD.

The main report is followed by Appendices that provide more detail. Detailed numerical and graphical results have been transmitted to SFPUC in the form of 46,930 electronic files totaling 122 mb.

TABLE OF CONTENTS

TABLE OF ABBREVIATIONS AND ACRONYMS

AC	Asbestos cement
AWSS	Auxiliary Water Supply System: the previous term for the existing high-pressure network, including pipes valving and hydrants (including currently motor operated valves), pump stations 1 and 2, Twin Peaks reservoir and Jones/Ashbury tanks. This network is now part of the EFWS.
BTCAR	Block Tree Canopy Area Ratio = tot. area tree canopy in block)/total area of the block
CAPSS	Community Action Plan for Seismic Safety (a City program, by the Department of Building Inspection)
CBD	Central Business District
CCSF	City and County of San Francisco
CDD	City Distribution Division
CGS	California Geological Survey
CI	Cast iron
Cisterns	Underground water tanks, typically circular with capacity of 75,000 gals.
csv	comma-separated variable (an electronic file format)
DEM	Digital elevation model
DI	Ductile iron
EFWS	Emergency Firefighting Water System: the complete set of water sources and systems for emergency firefighting – includes the high-pressure pipe network (with associated pump stations, tanks and Twin Peaks Reservoir), PEWFS, cisterns, fireboats, fireboat manifolds, pump stations, suction connections and other infrastructure.
FAR	Floor Area Ratio = TFA all buildings in city block)/total area of the block
FFEWRS	Fire Following Earthquake Water Requirements Study (this project)
GIS	Geographic Information System
GMPE	Ground motion prediction equation
gpm	gallons per minute
LDH	Large Diameter Hose
MCS	Monte Carlo Simulation
MMI	Modified Mercalli Intensity
MOV	Motor operated valve

MWSS	Municipal Water Supply System – that is, the normal potable water network
NERT	Neighborhood emergency response team
OES	Office of Emergency Services (Governor's Office, California)
PEWFS	Potable Emergency Water Firefighting System: a new system planned for the Richmond and Sunset and consisting of a pipe network from Lake Merced northwards to the Richmond and connecting to Sunset Reservoir, with pump stations at Lake Merced, Sunset Reservoir and perhaps at Sunset Pumping Plant. Will be operated as a potable trunk line supplied from Sunset Reservoir under normal conditions and switched to a high-pressure network (independent of the current high-pressure network) for firefighting when needed. When operating as a high-pressure network PEWFS if required may inject raw water from Lake Merced.
PGD	Permanent ground displacement
PGV	Peak Ground Velocity
SCADA	Supervisory control and data acquisition
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utility Commission
SRTM	Shuttle Radar Topography Mission (ie, satellite DEM data)
STL	Steel
TFA	Total Floor Area (sq. ft., the sum of floor area on all floors of a building)
USGS	US Geological Survey
Vs30	Shear wave velocity, top 30 meters
WSF	Water supply factor

LIST OF FIGURES

LIST OF TABLES

REPORT

Purpose

The purpose of this project has been the estimation of water required to suppress fires following a major earthquake affecting the city of San Francisco. Estimation of required water is needed to determine if the current water supply sources and conveyance infrastructure meet the requirements for firefighting, or if additional sources and infrastructure are required. Water demands are key criteria for assessing the adequacy of the existing Emergency Firefighting Water System (EFWS) and planning EFWS's future expansion.

Water supply and fire suppression

The water and fire services are co-equal members of the fire suppression team. Understanding this is crucial to the estimation of water requirements for fire suppression – one service complements the other with regard to fire suppression. This co-dependence greatly affects the total demand on the water system – if a rapid and adequate fire department response is met with adequate readily available water at the fireground, the fire is fought while relatively small and the total water demand modest. If the fire department response is delayed or water is a long time coming to the fireground, the fire rapidly grows to multi-alarm (or even multi-block) proportions, and the amount of required water is orders of magnitude greater.

Fire following earthquake model

The model that has been employed for this project (SPA FFE) is the result of decades of research and development (Anderson et al. 2016; Davidson et al. 2012; Porter, Scawthorn and Sandink 2021; Porter et al. 2011; Scawthorn 2008; Scawthorn et al. 1982; Scawthorn 1987; Scawthorn 2020; Scawthorn, Cowell and Borden 1998; Scawthorn and et al 2018; SPA Risk 2009; TCLEE 2005) and has been employed on behalf of numerous fire, water and other government agencies including San Francisco's Department of Building Inspection (ATC-52-1A 2010), and also for the insurance industry.

All results presented here are estimates based on this model and inputs as described below. These results and the services to develop them were performed for the San Francisco Public Utility Commission through a contract with AECOM Technical Services, Inc. (collectively, the "Client") within the limits prescribed by the Client, in a manner consistent with that level of care and skill ordinarily exercised by other professional consultants under similar circumstances at the time the services are performed. Considerable uncertainty exists regarding the occurrence and circumstances of large earthquakes, which may affect the results of this model. No other representation, express or implied, and no warranty or guarantee are included or intended in this report or otherwise.

San Francisco's buildings at risk

San Francisco has substantial buildings at risk. The value of the buildings at risk in the City is exceptionally large and will only become larger. When originally built, San Francisco had a population of 400,000 and only the northeast quadrant of the City was significantly built up, with large parts of the western portion of the City still in a natural state. San Francisco as of 2021 has been fully built out with a population of about 880,000, Figure 4, and is projected to grow by 2040 to more than 1.1 million. The City had 400,000 housing units in 2019 (Planning Department 2020) and is required to add 82,000 housing units by 2031 (ABAG 2021), an increase of 20.5% by 2031. The current total floor area of all buildings in the City is estimated to be 885 million sq. ft., is quite dense and largely of wood construction, Figure 1 and Figure 2, and is expected to grow to 1.1 billion sq. ft. by 2040 and 1.25 billion sq. ft. by 2050. Depending on meteorological conditions, conflagration hazard is exacerbated by vegetation and the tree canopy, which is accounted for in the analysis, Figure 3. Approximately 24% of all floor area is in high-rise buildings, a significant fire in any one of which will challenge SFFD. The aggregate structure and contents replacement value of all buildings in the City is about $530 billion (2021 $) which by 2040 will grow to perhaps $665 billion, in current dollars. Beyond this potential loss in direct property damage, San Francisco is the financial and mercantile center of Northern California and its dysfunction will significantly impact larger economies, as occurred in 1906 (Odell and Weidenmier 2004).

Figure 1 Block Floor Area Ratio[1] per city block, showing density of buildings in the City.

[1] As used here, Block Floor Area Ratio = BFAR = (TFA all buildings in city block)/total area of the block

Figure 2 View of San Francisco residential neighborhood showing density of wood frame construction

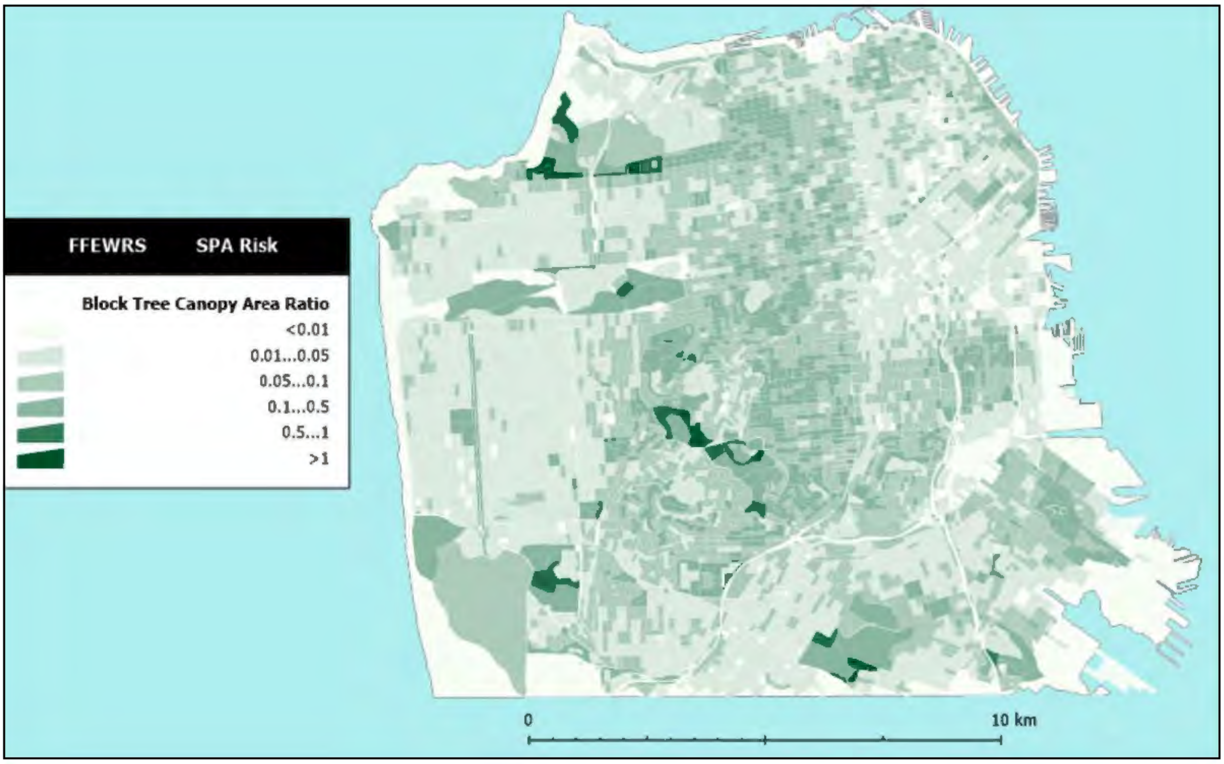


Figure 3 Block Tree Canopy Area Ratio[2] per city block, showing density of tree canopies in the City.

[2] As used here, Block Tree Canopy Area Ratio = BTCAR = (tot. area tree canopy in block)/total area of the block

San Francisco's earthquake risk

San Francisco is at major risk due to earthquake, with the City's downtown being equidistant from the San Andreas and Hayward faults, Figure 4. The study examined two major seismic events: (1) a Mw 7.9 event on the San Andreas fault like the 1906 event, and (2) a Mw 7 event on the Hayward fault in the East Bay. These two events were among those examined in the Department of Building Inspection's CAPSS study (ATC-52-1 2010).

Ground motions from either of these events will be very strong in San Francisco, with the Mw 7.9 San Andreas event being generally stronger, especially in the western portions of the City, which are only a few miles from that fault, Figure 5 (the Hayward event, while generally having similar or smaller ground motions than the San Andreas event, is considered more likely to occur in the near future).

To account for uncertainty in ground motions, a probabilistic Monte Carlo Simulation (MCS) was employed, and permanent ground displacements (PGD) due to liquefaction were accounted for using USGS data (Knudsen et al. 2000), see Figure 6.

Figure 4 San Francisco low and medium rise building total floor area per block. Arrows show distance Ferry Building equidistant from San Andreas and Hayward faults.

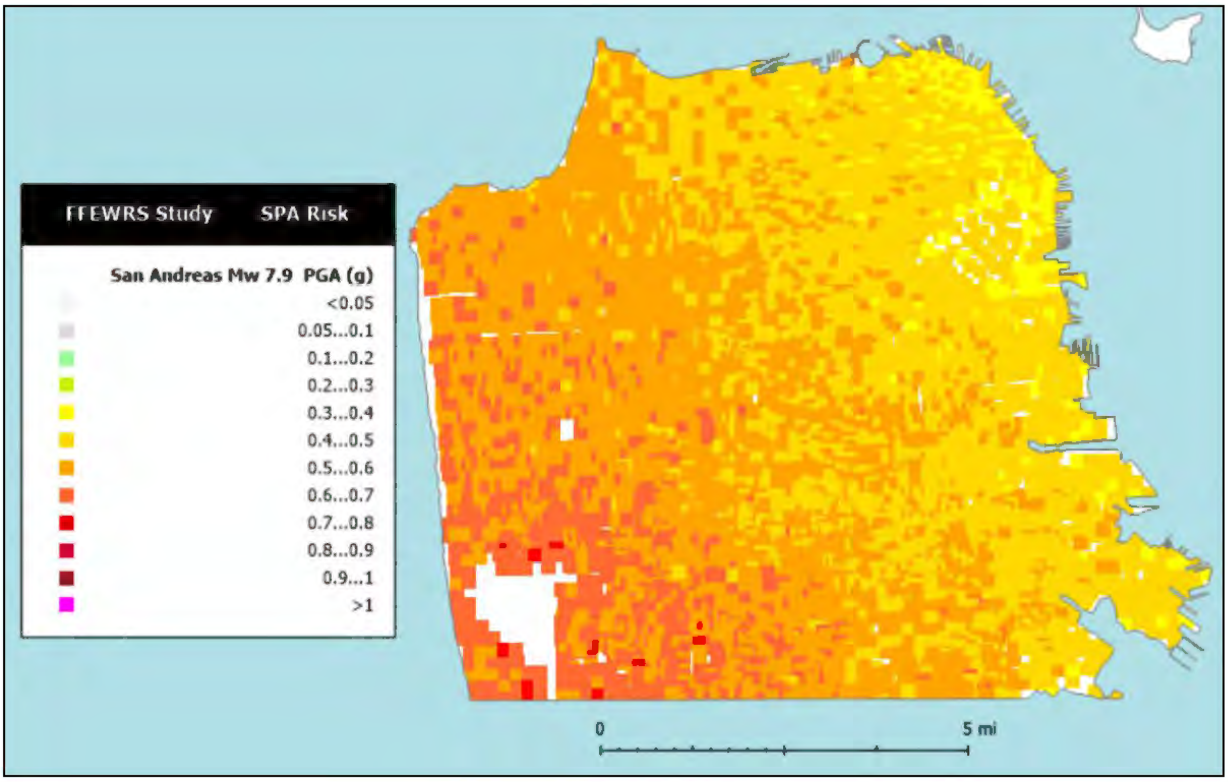


Figure 5 One realization of estimated ground motions due to a Mw 7.9 San Andreas earthquake.

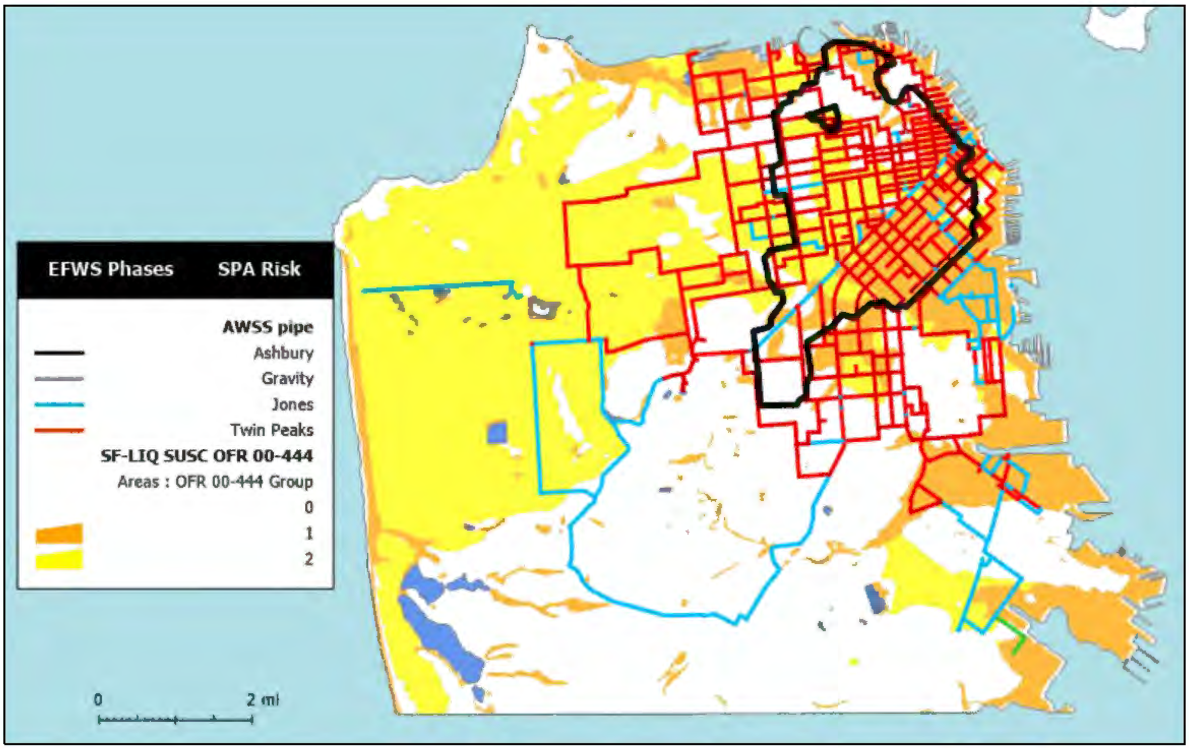


Figure 6 Existing EFWS high-pressure pipe network overlaid on liquefaction susceptibility areas, 1906 burnt area (black outline), colors show pipe materials (CI = cast iron, DI = ductile iron, ERDIP = earthquake resistant ductile iron pipe)

San Francisco Fire Department

The San Francisco Fire Department (SFFD) is the front line in protecting San Francisco against the risk of earthquakes and fires that may follow. SFFD is a first-class department that has historically been a leader in the fire service. However, SFFD will be extremely challenged by a major earthquake – while it has 1,449 personnel, it has only 44 stations and in-service engines (including one at Treasure Island, but not counting engines at San Francisco International Airport), 20 ladder trucks, 4 hose tenders, 3 fire boats and various other equipment.

A repeat of the 1906 earthquake will likely generate on average about 130 fires in the first 24 hours under current conditions, Figure 7 – this average will increase with the City's growth to about 160 by 2050. Due to the number of fires exceeding SFFD's available resources, some of these ignitions may grow to conflagration proportions well beyond SFFD's capability to fight. Mutual aid following a large earthquake will probably take many hours to arrive. Firefighter fatigue is a factor that will limit firefighting over time (the analysis assumes responding off-duty firefighters offset this).

Most significantly, SFFD can do little to fight fires if it has no water. Under non-earthquake conditions, SFFD accesses firefighting water from either the Municipal Water Supply System (MWSS, that is, the low-pressure potable water mains) and/or the EFWS high-pressure pipe network. The MWSS is not designed for earthquake and is anticipated to have hundreds of water main breaks and leaks in a major earthquake, such that large portions will lose pressure, resulting in dry MWSS hydrants.

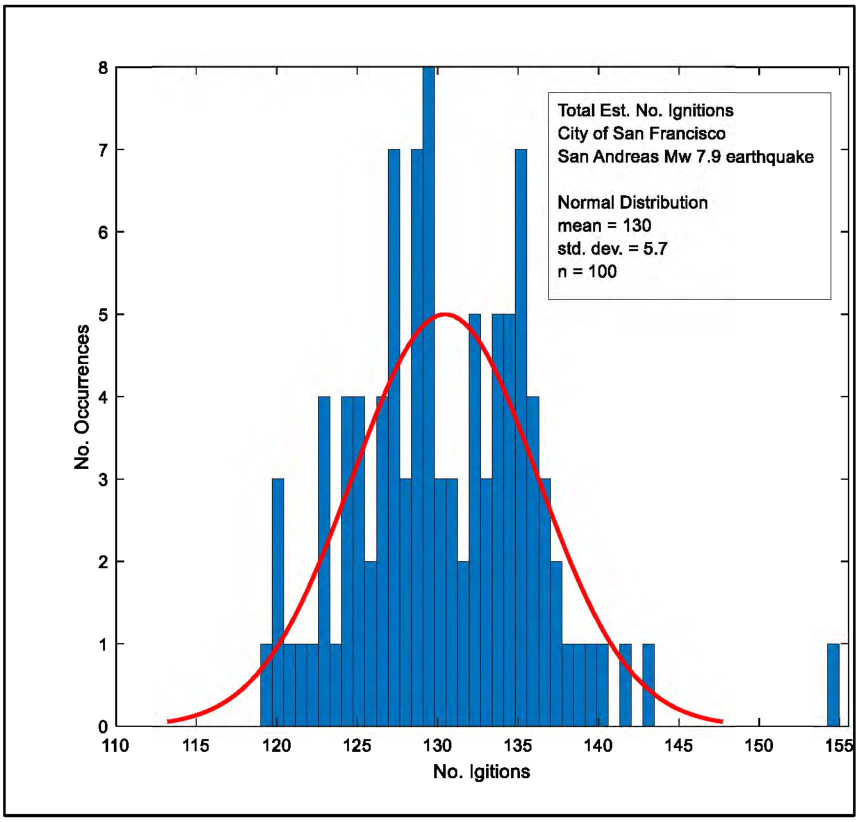


Figure 7 Histogram of estimated total number of ignitions for Mw 7.9 San Andreas event under current conditions. Current mean of 130 ignitions will grow to about 160 ignitions by 2050.

Emergency Firefighting Water System

The Emergency Firefighting Water System (EFWS) is the backup to the MWSS for firefighting. EFWS is the aggregation of all the City's water sources and systems for emergency firefighting, including the high-pressure pipe network, cisterns, fireboats, fireboat manifolds, pump stations, suction connections, and other infrastructure. The EFWS high-pressure pipe network was initially constructed following the 1906 earthquake and fire and at that time covered only the built-up northeast quadrant of the City, Figure 8. The system was designed to provide large volumes of water for firefighting, particularly after a major earthquake, and be independent of the potable water supply system which had hemorrhaged water in 1906 due to many breaks in mains and 28,000 service line leaks. San Francisco has continued to invest in expanding the high-pressure system (to the Mission and Western Addition in the 1930s, and elsewhere in the 1970s and 80s), Figure 8 and Figure 9. Due to its age, much of the existing high-pressure pipe is cast iron, Figure 8, which is a relatively brittle material and subject to breaks in an earthquake. Moreover, the system still does not extend to the western or southern portions of the City although some protection for those districts is provided by cisterns, Figure 10, which however are limited in their capacity (typically, 75,000 gallons equivalent to one hour's supply for one fire engine). That is, cisterns can provide sufficient water for an initial attack and thus would allow the fire department to suppress some fires at an early stage (if the fire engines arrived at that stage), but are probably insufficient for greater alarm fires, not to mention conflagrations.

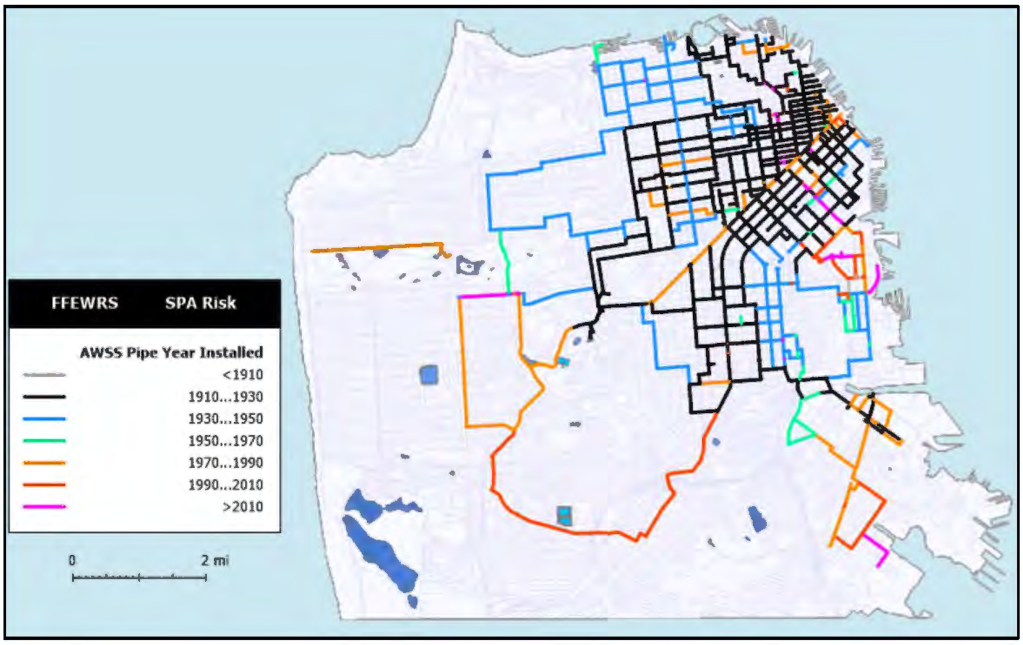


Figure 8 Existing EFWS high-pressure pipe network, colors show year installed, with black lines showing the original 1912 high-pressure pipe network

This analysis considers a phased expansion in the EFWS, including construction of the Potable Emergency Water Firefighting System (PEWFS) to be built in the Richmond and Sunset districts as well as extensions and improvements to the high-pressure pipe network. Three phases of EFWS expansion are considered, with timing of the phase's dependent on funding.

Demands for these phases are based on projected population and building inventories for 2030, 2040 and 2050. The specific buildouts corresponding to each phase that were used for future projections in this study are shown in Figure 11 – note specific alignments of pipe and other features is likely to change as the design of the EFWS progresses.

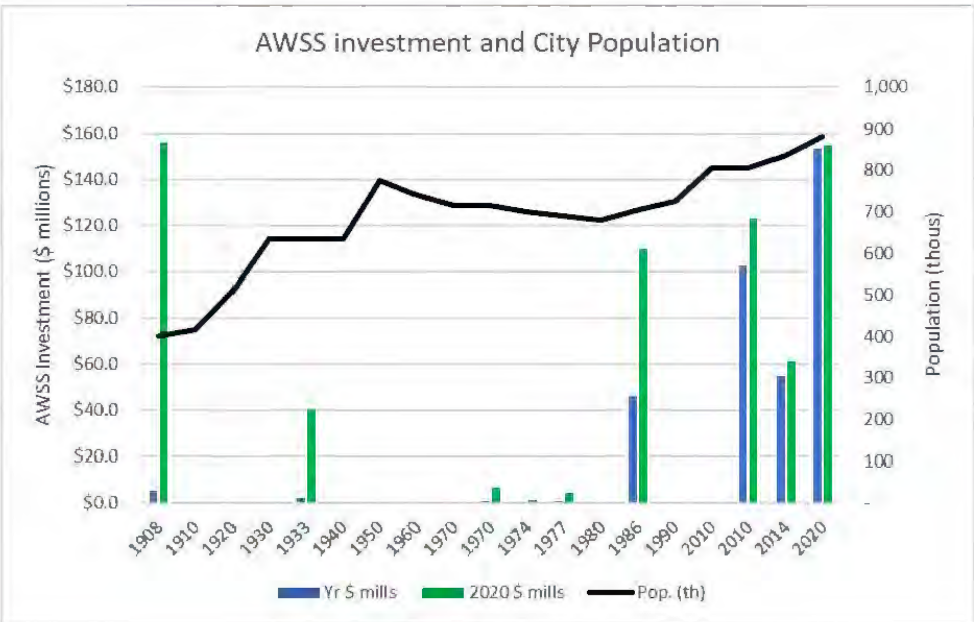


Figure 9 EFWS investment in both $ for that year (blue column) and 2020$ (green column), and City's population (black line)

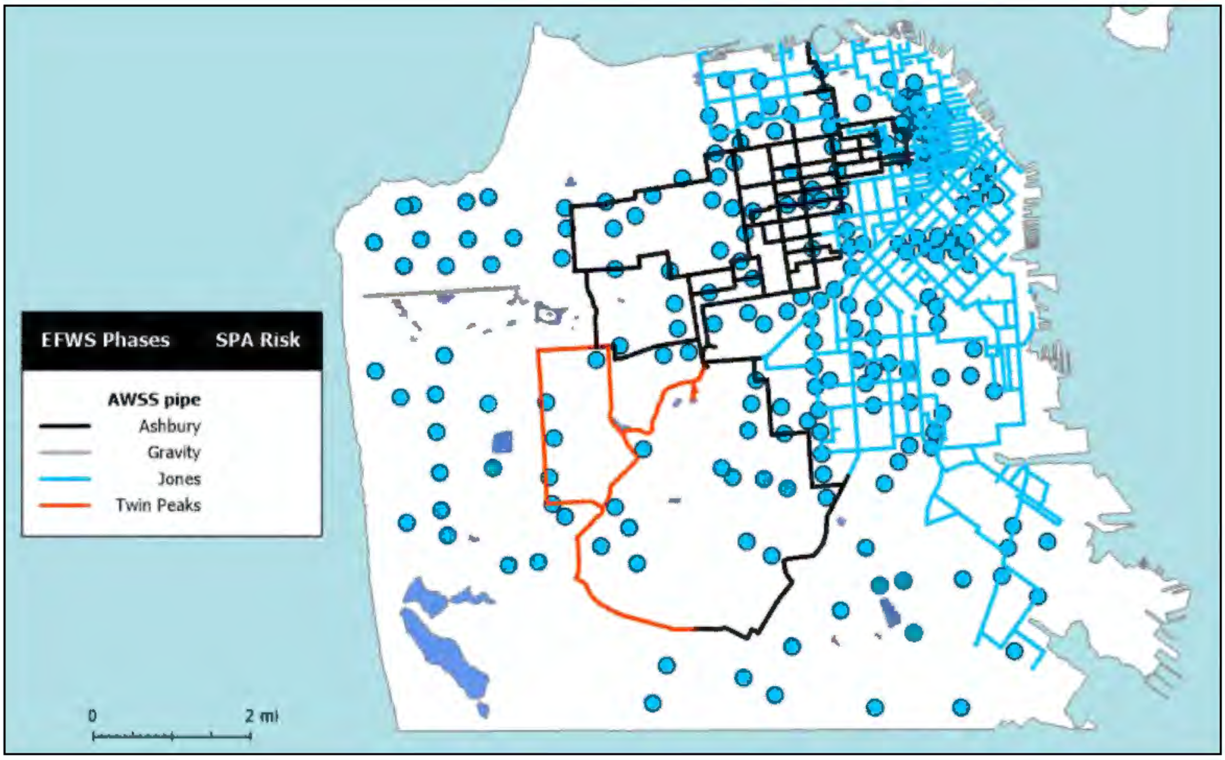


Figure 10 Existing EFWS high-pressure pipe network, colors show pressure zones, circles are cisterns

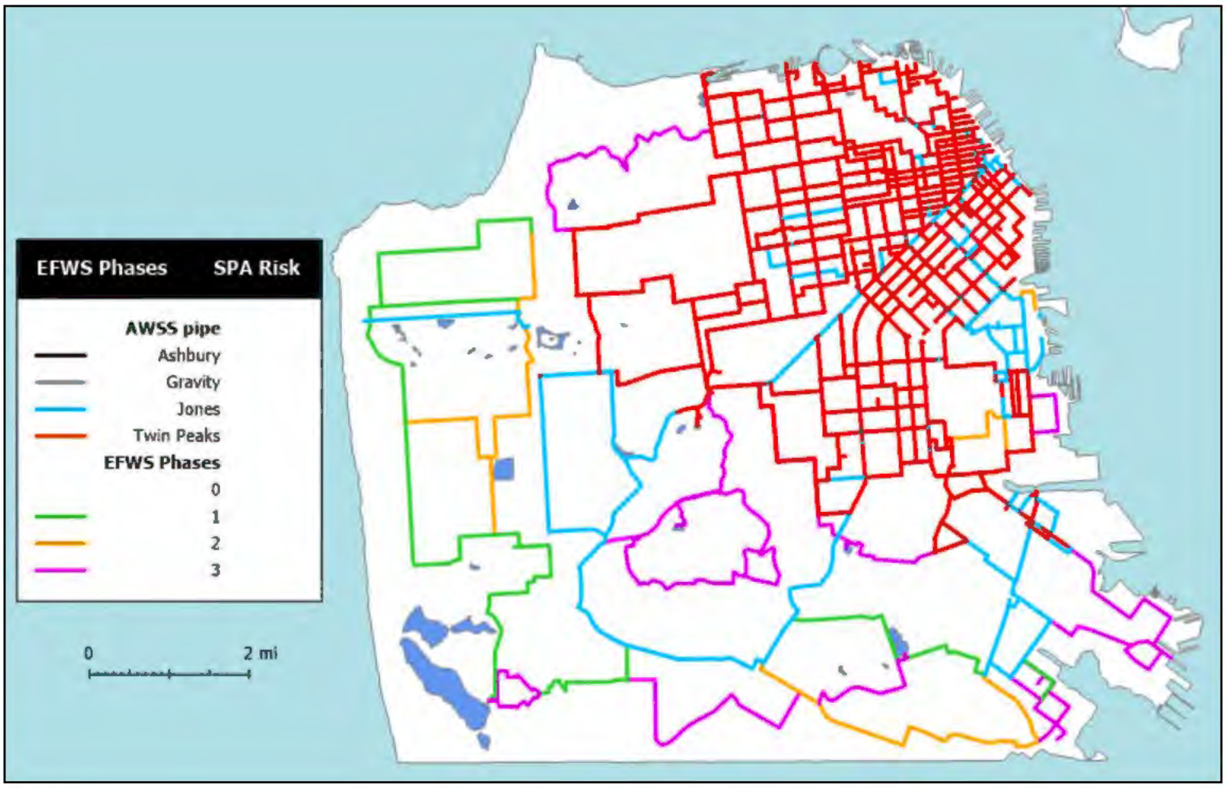


Figure 11 Existing EFWS high-pressure pipe network (Ashbury, Gravity, Jones and Twin Peaks pressure zones) and Phases 1, 2 and 3 preliminary EFWS future buildouts – note specific alignments of pipe and other features is likely to change as the design of the EFWS progresses.

Analysis of fire following earthquake

Fire following earthquake involves considerable uncertainty and is modeled as a stochastic process. Time is of the essence for fires following earthquakes. Figure 12 shows a Fire Department Operations Timeline, in which the horizontal axis is Time, beginning at the time of the earthquake, while the vertical axis presents a series of horizontal bars of varying width. Each of these bars depicts the development of one fire, from ignition through growth or increasing size (size is indicated by the width or number of bars).

Analysis of firefighting water demands is complex and consists of modeling the following steps (see Figure 13):

- *Occurrence of the earthquake* –earthquake shaking causes damage to buildings and contents, even if the damage is as simple as knocking things (such as candles or lamps) over. For this study, two scenario earthquakes are examined, a Mw 7.9 event on the San Andreas fault, and a Mw 7.0 event on the Hayward fault, with both events epicenters assumed close to San Francisco. Ground motions for the events are estimated using a suite of appropriate ground motion prediction equations in a probabilistic format accounting for spatial correlation. Ground failure is estimated based on liquefaction susceptibility maps.

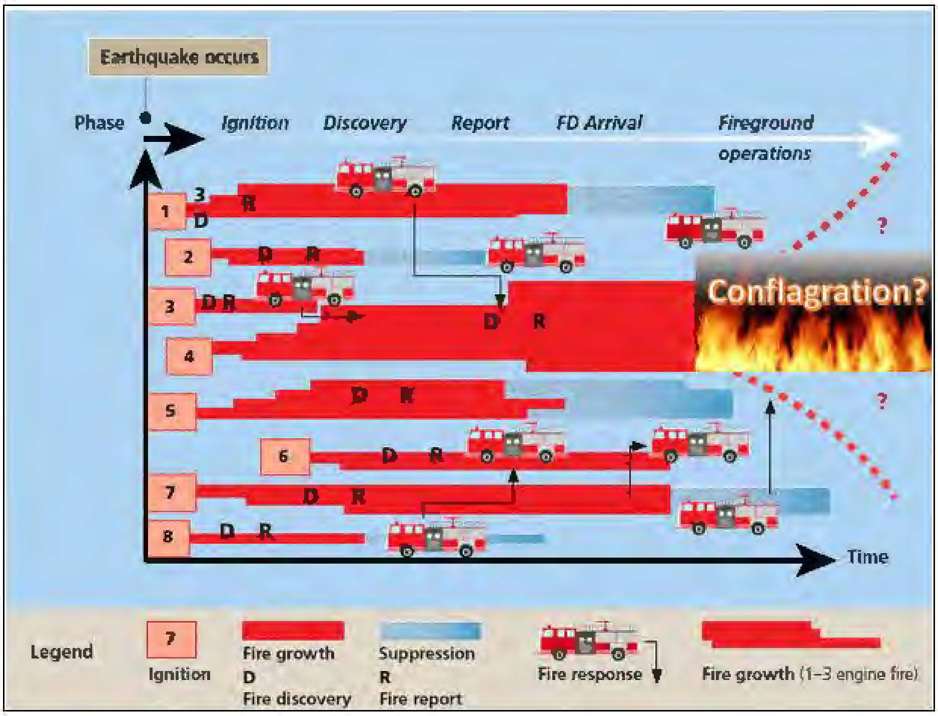


Figure 12 Fire department operations time line. Horizontal axis is time, beginning at time of earthquake. Horizontal bars depict development of fires, from ignition through growth or increasing size (size is indicated by width or number of horizontal bars).(Scawthorn 1987)

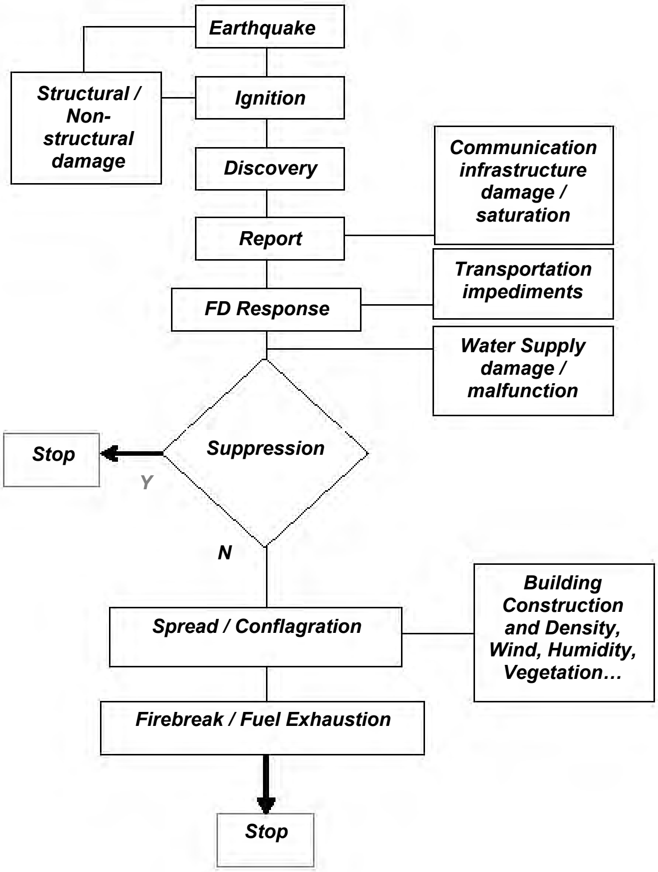


Figure 13 Flow chart of fire-following-earthquake process (TCLEE 2005)

- *Assets at risk* – a database or building inventory for the City was compiled based on a variety of sources, including projections of future growth and traffic patterns. The spatial database consists of a record for each building in the City, with fields specifying location (block, latitude and longitude), date of construction, type of occupancy, primary construction material, number of stories, total floor area, building footprint shape and area.
- *Ignition* – whether a building has been damaged or not, ignitions can occur due to earthquakes. The sources of ignitions are numerous, ranging from overturned heat sources to abraded and shorted electrical wiring, to spilled chemicals having exothermic reactions, to friction of things rubbing together. For this study, ignitions are based on correlations with ground motion developed by this author for FEMA and used in the national earthquake model Hazus-MH (FEMA 2003). The correlations are empirical – that is, based on observations of past events – and no adjustment has been made here for future projections. While to some extent older construction in San Francisco will be replaced by more modern buildings, the lack of adjustment is based on several factors: (i) a lack of observed change over time in the normalized ignition rate for past events; (ii) post-earthquake ignitions are only partially correlated with structural performance, and are due more to appliances and contents sources, which are likely to more slowly change over time; (iii) while San Francisco's energy policies are shifting away from natural gas, this will entail a shift towards electric power, another ignition source; (iv) a rapidly increasing trend toward rooftop solar and home storage (e.g., Tesla Powerwall), which represent a new post-earthquake ignition source. The conclusion was that a future trend in post-earthquake ignitions may arguably be increasing or decreasing over the next few decades, and no specific adjustment could be justified. Lastly, given the disparity between the number of estimated ignitions and SFFD capability, any reasonable adjustment was unlikely to significantly change the overall results.
- *Fire growth* – fires grow very rapidly, the growth depending on many factors primary of which are the available fuel and oxygen supply, and how soon the fire is fought. As fires increase in size, building compartmentation, inter-building spacing, fenestration, cladding and windspeed are all important factors. An unfought fire in a densely built-up residential neighborhood can progress from a candle-sized to sofa-sized to room flashover within a very few minutes. Room-to-room and then building-to-building (and then block-to-block) fire spread are modeled based on a large body of data (TCLEE 2005) that incorporates radiative, convective and ember effects on building cladding, interiors and also the City's tree canopy. Weather (wind speed and direction, temperature, precipitation, relative humidity) are all considered probabilistically.
- *Discovery* – at some point, the fire resulting from the ignition will be discovered. In the confusion following an earthquake, the discovery may take longer than otherwise.
- *Report* – if it is not possible for the person or persons discovering the fire to immediately extinguish it, fire department response will be required. Only fires that require fire department response are modeled in this study. For the fire department to respond, a Report to the fire department typically has to be made, but the possibility of fire companies directly observing a fire and self-dispatching is considered in the analysis. Communications system dysfunction and saturation may delay some reports.
- *Response* – the fire department then has to respond but may be impeded by non-fire emergencies they may also have to respond to (e.g., building collapse) as well as

transportation disruptions. In this study the assumption however is that fires are the first priority for all available fire engines (i.e., pumpers). Fire trucks (i.e., ladders) are a vital type of apparatus crucial to normal firefighting, but don't actually carry hose or a pump, so that fire engines are the critical element considered in the analysis. Initially, 43 fire engines are considered available (the apparatus on Treasure Island and at San Francisco International Airport are not considered available within the Peninsular City). SFFD has five fully equipped engines in ready reserve and the analysis assumes off-duty personnel would respond such that these engines would be in service two hours following a major earthquake, so that 48 engines are available at hour 2 following the earthquake. Additionally, there are five more engines that the analysis assumes would be equipped and in service four hours following the earthquake (ie, 53 engines at hour 4). A factor examined but not explicitly included in this analysis is the prevalence of overhead wires, both for Muni and electrical distribution. Some of these wires will come down due to shaking and ground failure, and pose two problems – they will impede traffic, particularly because motorists will not know if the wires are energized and thus will proceed with caution, and because they will require urgent SFFD response.

- *Mutual aid* – Regarding mutual aid, the analysis assumes no mutual aid for the first 12 hours. Thereafter, mutual aid strike team arrive every two hours for the period 12-24 hours, following which as many engines as needed are available. Aerial attack by tanker aircraft as typically used in wildland fires, is unlikely in San Francisco and is not considered in the analysis. These resource and operational aspects of the modeling were reviewed with SFFD senior Chiefs.
- *Water supply* – upon arrival at the fireground, water is needed for fire suppression. Fire engines typically have a 500-gallon tank, which can be used for quick attack and suppression of small fires but is inadequate if a fire is much beyond one room in size. The first choice for water supply will be a fire hydrant – an EFWS hydrant if available, otherwise a potable water hydrant supplied by the MWSS. However, earthquake shaking and PGD effects will cause pipe breaks and leaks in both the EFWS and MWSS. The MWSS is likely to have hundreds of breaks and leaks, such that large portions of the system will lose all pressure, resulting in dry hydrants. The EFWS has been designed and constructed to minimize earthquake damage, but much of the EFWS high-pressure pipe network, particularly the older portions, are likely to sustain some breaks and leaks such that the Lower or Jones Street Zone of the high-pressure pipe network (see Figure 10), which serves a large part of the City, may lose pressure. This is what occurred in the 1989 Loma Prieta earthquake, and the potential for this remains today although the SFPUC has made several improvements to the existing EFWS. Performance of the EFWS is accounted for in the analysis by considering damage to the pipe network and the probability of system operations being able to maintain functionality (Porter 2018). Cisterns and other sources of water (Bay suction connections, fireboats, Stowe Lake and other bodies of water, swimming pools) are included in the calculation of the probability of water be supplied at the fireground. Affecting this probability is distance from the water source to the fireground. Longer distances require longer lays of hose which may require more than one engine for relay purposes. SFFD's hose tenders, each carrying about 4000 ft. of Large Diameter Hose (LDH, typically 5-inch diameter) are a major asset in this regard and considered in this analysis.
- *Suppression* –the analysis models fire department suppression, beginning with the assumption that all fire engines are in their assigned fire station at the time of the earthquake,

and all fire engines and personnel are immediately available for service. As discussed above, as fire reports are received or fires detected directly by engine companies, the fire engines travel directly to the fire nearest to their fire station. If a second fire is in the neighborhood, since the fire engine has committed to the first fire, a different fire engine is required to respond to the second fire, which requires a longer travel time resulting in the fire being larger on arrival than it would have been if there had only been one fire.

- If sufficient water is available at the fireground, the fire is fought. If the first engine is insufficient for full suppression, additional engines are assigned, and travel to the fire, which requires more time. During this time, the fire continues to grow, albeit somewhat abated due to the firefighting by on-scene fire engines. This process continues, with more and more engines arriving and slower and slower fire growth, until growth is contained. The flow of water required (in gallons per minute, gpm) during these activities is calculated based on empirical and theoretical models. As the fire is suppressed or fuel is exhausted, fire engines remain at the fireground for some time, both for overhaul and equipment and hose retrieval. As soon as possible, fire engines are released to go to other fires.

  The total amount of water employed at the fire may be calculated in various ways with the measure used here being Required Water, which is the water flow that is required to suppress the fire at that moment, taking into account fire department suppression activities up to that time (other measures are Actual Water, Available Water and Theoretical Water, see Appendices for details, but Required Water is the most relevant measure for our purposes).

- If no water is available at the fireground, even considering hose relays, hose tenders and other resources, the first arriving engine remains on scene for an assumed period, typically to assure life safety. No further engines are assigned to the fire, which continues to grow. When the fire has grown and spread to a neighboring block, an assessment is made again regarding water availability – if water is available, then the process described in the preceding paragraph is followed, if not, then the fire grows unabated and the Required Water is substantially more than if water had been available.

- Whether water is available or not, there will be cases where the fire grows to sufficient size to spread to another block – that is, cross a street or other intervening distance. Data on street widths, parks and other "gaps in fuel" are employed in the analysis, and the probability of "crossing", in four directions, is considered for each block in which an ignition occurs, considering whether or not active suppression is present.

- At each ignition, if the engine company or companies achieve suppression (not just control, but suppression), they move on to the next incident after a limited amount of time (less than usual) for overhaul to avoid rekindles. Until control is accomplished, on scene engine companies (including further arriving companies, as available) continue to attempt to contain the fire but it spreads albeit at a slower rate and may still become a conflagration. Success or failure hinges on numerous factors including fire engine availability, water supply functionality, building construction and spacing, wind and humidity conditions, etc. If the fire cannot be contained, the process ends when the fuel is exhausted – that is, when the fire fails to cross a firebreak, such as a city street or large area (e.g., park). Probability of crossing a firebreak is based on the size of the fire, windspeed, the width of the firebreak and nature of the fuels on both sides of and within the firebreak (including tree canopy).

Uncertainty

To account for uncertainty, the Monte Carlo Simulation (MCS) method was employed in the analysis. MCS is a widely used method for incorporating uncertainty due to a stochastic process. Simply put, MCS consists of assigning probability distributions to those variables in a process that have significant uncertainty (i.e., the random variables) and using random numbers to independently assign a point value to each random value for a specific trial. Each random variable having a point value permits calculation of the process and its result, which is termed a realization. Repeating the use of new random numbers to assign a new point value to each random value for the next trial yields a new realization. N repetitions yields N realizations, which approximates the probability distribution of the result of the random process. The number of realizations required depends on the desired confidence in the result and can vary from dozens to millions depending on the process and associated uncertainties, and desired confidence. MCS was employed for this analysis, with the following variables having uncertainty:

- Ground motion: uncertainty as determined by the suite of NGA-West2 ground motion prediction equation (Gregor et al. 2014), with inclusion of spatial correlation.
- Weather (temperature, humidity, wind speed and direction, precipitation) randomly sampled from five years of hourly data
- Ignition location and frequency based on random sampling of a function of total floor area database for San Francisco using relationships employed in Hazus-MH (SPA Risk 2009)
- Damage to and serviceability of the EFWS based on (Porter 2018) approach using data on ground motion, pipe diameter and material
- Water supply based on random sampling of serviceability of and distance to the EFWS and alternative water sources
- Fire growth and spread based on randomness in ignition location, neighboring buildings, inter-building spacing, tree canopy, building material of construction, temperature, relative humidity, recent precipitation, windspeed and wind direction, number of fire engines on scene and availability of water for firefighting.

A study was conducted as to a reasonable minimum number of MC simulations required for stable median, mean and variance results, finding that 50 simulations per case was a reasonable minimum. Results presented here are based on 100 simulations.

Analysis Cases

The Monte Carlo Simulation was applied to a number of cases which are denoted

“Phx v1v2v3v4v5”

where

Phx refers to Phasesx, where x= 0 is the situation as of 2020, and x= 1, 2 and 3 refers to succeeding stages of EFWS buildout and City growth.

v1 denotes whether and how **system damage** is considered – that is, v1 = D denotes EFWS pipe breaks and leaks are included in the analysis, v1 = N considers the system to be undamaged, and v1 = P triggers a probabilistic weighting of damage occurrence.

v2 denotes whether and how EFWS **system operational efficiency** is considered – that is, v2 = L denotes a slow operational response to EFWS damage, with some time required to assess damage and respond with valve closures and other measures, v1 = M denotes a moderate operational response, v3 = H denotes good situational awareness (e.g., via a high-resolution SCADA) and rapid response (e.g., via a dense network of automatic or remotely operable motor operated valves, MOVs), and v3=E denotes efficient system operations, significantly exceeding v3=H such that the system is fully functional almost without interruption.

v3 denotes whether EFWS **system improvements** have been implemented – that is, v3 = Y denotes EFWS system expansion and improvements for that Phase have been implemented, while v3 = N denotes no improvements (i.e., same as in 2020).

v4 denotes whether **SFFD resources have been increased** – that is, v4 = C denotes the current number of SFFD fire engines (initially 43, as described above) are what is available for that Phase, while v4 = A considers SFFD has been increased in size with additional engines and hose tenders commensurate with the population growth for that Phase.

v5 denotes whether **City growth** is considered – that is, v5 = B the current population and building inventory, while v5 = F denotes population and growth projections for 2030 (Phase 1), 2040 (Phase 2) and 2050 (Phase 3) were employed. Use of these specific years is not meant to imply that EFWS expansion will occur by that year.

Thus, for example, **Ph0 DLNCB** denotes an analysis for Ph0 (i.e., the current EFWS) considering Damage to the system, Low system operational response to that damage, No system improvements, Current SFFD resources and current (i.e., 2020) City growth, the latter three variables being consistent with Ph0. Another example: Ph3 PHNAF denotes Phase 3, Probabilistic weighting of damage, High system operational response to that damage, No system improvements, a larger SFFD with more resources and Future (i.e., 2050) City growth.

Feasible combinations of Phases and v1 to v5 are 91 in total, Table 1.

Table 1 Case List

Case	Ph	sysDmg	sysEff	sysImpr	SFFD	Growth
1	0	D	L	N	C	B
2	0	D	M	N	C	B
3	0	D	H	N	C	B
4	0	N	E	N	C	B
5	0	P	L	N	C	B
6	0	P	M	N	C	B
7	0	P	H	N	C	B
8	1	D	L	Y	C	F
9	1	D	L	Y	A	F
10	1	D	L	N	C	F
11	1	D	L	N	A	F
12	1	D	M	Y	C	F
13	1	D	M	Y	A	F
14	1	D	M	N	C	F
15	1	D	M	N	A	F
16	1	D	H	Y	C	F
17	1	D	H	Y	A	F
18	1	D	H	N	C	F
19	1	D	H	N	A	F
20	1	N	E	Y	C	F
21	1	N	E	Y	A	F
22	1	N	E	N	C	F
23	1	N	E	N	A	F
24	1	P	L	Y	C	F
25	1	P	L	Y	A	F
26	1	P	L	N	C	F
27	1	P	L	N	A	F
28	1	P	M	Y	C	F
29	1	P	M	Y	A	F
30	1	P	M	N	C	F
31	1	P	M	N	A	F
32	1	P	H	Y	C	F
33	1	P	H	Y	A	F
34	1	P	H	N	C	F
35	1	P	H	N	A	F
36	2	D	L	Y	C	F
37	2	D	L	Y	A	F
38	2	D	L	N	C	F
39	2	D	L	N	A	F
40	2	D	M	Y	C	F
41	2	D	M	Y	A	F
42	2	D	M	N	C	F
43	2	D	M	N	A	F
44	2	D	H	Y	C	F
45	2	D	H	Y	A	F
46	2	D	H	N	C	F
47	2	D	H	N	A	F
48	2	N	E	Y	C	F
49	2	N	E	Y	A	F
50	2	N	E	N	C	F
51	2	N	E	N	A	F
52	2	P	L	Y	C	F
53	2	P	L	Y	A	F
54	2	P	L	N	C	F
55	2	P	L	N	A	F
56	2	P	M	Y	C	F
57	2	P	M	Y	A	F
58	2	P	M	N	C	F
59	2	P	M	N	A	F
60	2	P	H	Y	C	F
61	2	P	H	Y	A	F
62	2	P	H	N	C	F
63	2	P	H	N	A	F
64	3	D	L	Y	C	F
65	3	D	L	Y	A	F
66	3	D	L	N	C	F
67	3	D	L	N	A	F
68	3	D	M	Y	C	F
69	3	D	M	Y	A	F
70	3	D	M	N	C	F
71	3	D	M	N	A	F
72	3	D	H	Y	C	F
73	3	D	H	Y	A	F
74	3	D	H	N	C	F
75	3	D	H	N	A	F
76	3	N	E	Y	C	F
77	3	N	E	Y	A	F
78	3	N	E	N	C	F
79	3	N	E	N	A	F
80	3	P	L	Y	C	F
81	3	P	L	Y	A	F
82	3	P	L	N	C	F
83	3	P	L	N	A	F
84	3	P	M	Y	C	F
85	3	P	M	Y	A	F
86	3	P	M	N	C	F
87	3	P	M	N	A	F
88	3	P	H	Y	C	F
89	3	P	H	Y	A	F
90	3	P	H	N	C	F
91	3	P	H	N	A	F

In consultation with SFPUC and AECOM it was determined that not all 91 possible cases need be analyzed, so that 21 cases were analyzed, consisting of Cases:

1) 1 Ph0 DLNCB
2) 2 Ph0 DMNCB
3) 3 Ph0 DHNCB
4) 4 Ph0 NENCB
5) 20 Ph1 NEYCF
6) 22 Ph1 NENCF
7) 48 Ph2 NEYCF
8) 50 Ph2 NENCF
9) 64 Ph3 DLYCF
10) 65 Ph3 DLYAF
11) 66 Ph3 DLNCF
12) 67 Ph3 DLNAF
13) 68 Ph3 DMYCF
14) 69 Ph3 DMYAF
15) 72 Ph3 DHYCF
16) 73 Ph3 DHYAF
17) 74 Ph3 DHNCF
18) 75 Ph3 DHNAF
19) 76 Ph3 NEYCF
20) 77 Ph3 NEYAF
21) 78 Ph3 NENCF

These 21 cases were run for both the San Andreas Mw 7.9 and Hayward Mw 7 scenario events, so in total 42 cases were run.

Results

This section presents summary results for the 21 Cases for the San Andreas Mw 7.9 and Hayward Mw 7 scenarios. Results for both scenario events are presented in greater detail in Appendix section 5, and complete results have been uploaded to SFPUC SharePoint website in a zip file containing 46,930 electronic files totaling 122 mb, the structure of which is detailed in Appendix section 5.3.

Format of results

Results for each case in the zip file are contained in folders which consist of 100 simulations, each of which is contained in a subfolder which contains comma-separated variable (csv) files an example of which is shown in Figure 14. Each csv file provides Required Water, Area Burned etc for each time step. For example, the Required Water (“reqWater”) timeline is shown in Figure 14 (note the view is split in four quadrants) and shows for each of 91 ignitions (the number of ignitions for this simulation – the number varies with each simulation; note that each row represents an ignition) the Required Water flow (gpm) at minute 0 (col A), minute 10 (col B) and so on to minute 1500 (col ET), each column being a 10 minute timestep. Total Required Water per fire in gallons is simply the summation of a row (times 10) and total water flow (gpm) for a trial at any 10-minute time step is simply the summation of that column.

	A	B	C	D	E	F	G	H	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET
1	0	181	147	125	107	92	79	67	0	0	0	0	0	0	0	0	0	0	0
2	0	269	215	181	155	133	114	98	0	0	0	0	0	0	0	0	0	0	0
3	66	50	42	36	31	26	23	19	0	0	0	0	0	0	0	0	0	0	0
4	82	61	51	43	37	32	27	23	0	0	0	0	0	0	0	0	0	0	0
5	87	67	56	48	41	35	30	26	0	0	0	0	0	0	0	0	0	0	0
6	0	102	83	70	60	51	44	38	0	0	0	0	0	0	0	0	0	0	0
7	39	31	26	22	19	16	14	12	0	0	0	0	0	0	0	0	0	0	0
8	0	343	246	203	173	148	128	110	0	0	0	0	0	0	0	0	0	0	0
9	53	371	309	264	227	195	167	142	0	0	0	0	0	0	0	0	0	0	0
10	120	86	71	60	52	45	38	33	0	0	0	0	0	0	0	0	0	0	0
11	86	62	51	43	37	32	27	23	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	13	10	8	5	3	1	0	0	0	0	0
84	0	0	0	0	0	0	0	0	12	10	8	6	4	2	1	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	132	106	90	77	66	57	48
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
91	0	0	0	0	0	0	0	0	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500

Figure 14 Example contents of file "reqWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57" (note the view is split in four quadrants)

Ignitions

The scenario events cause a large number of ignitions – on average 130 ignitions for the San Andreas event and 42 for the Hayward event, as shown in Figure 15 and Figure 16.

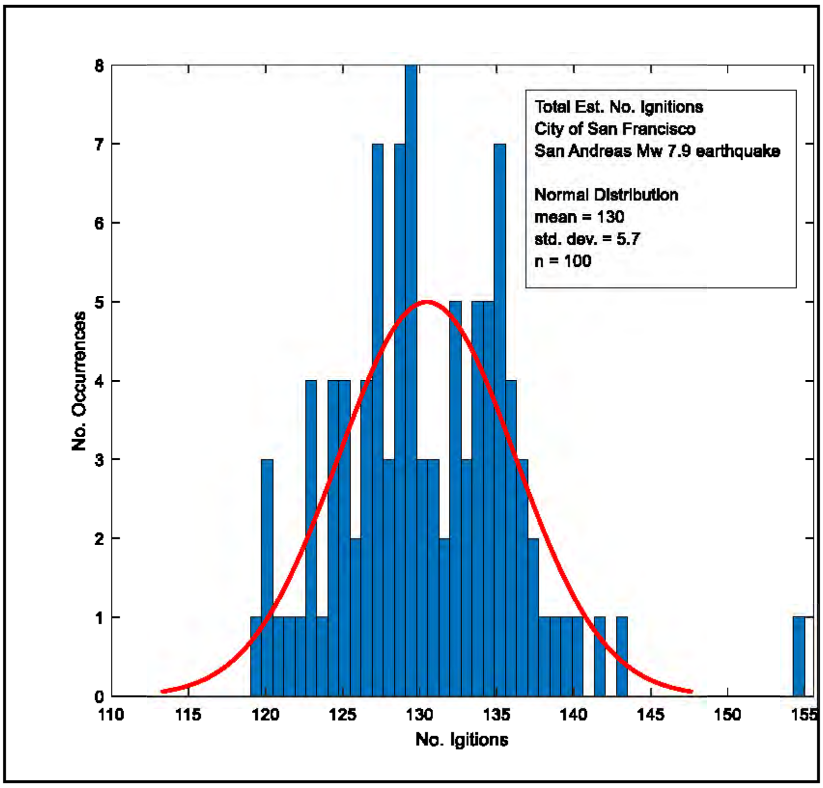


Figure 15 Histogram of estimated total number of ignitions for Mw 7.9 San Andreas event under current conditions. Current mean of 130 ignitions will grow to about 160 ignitions by 2050.

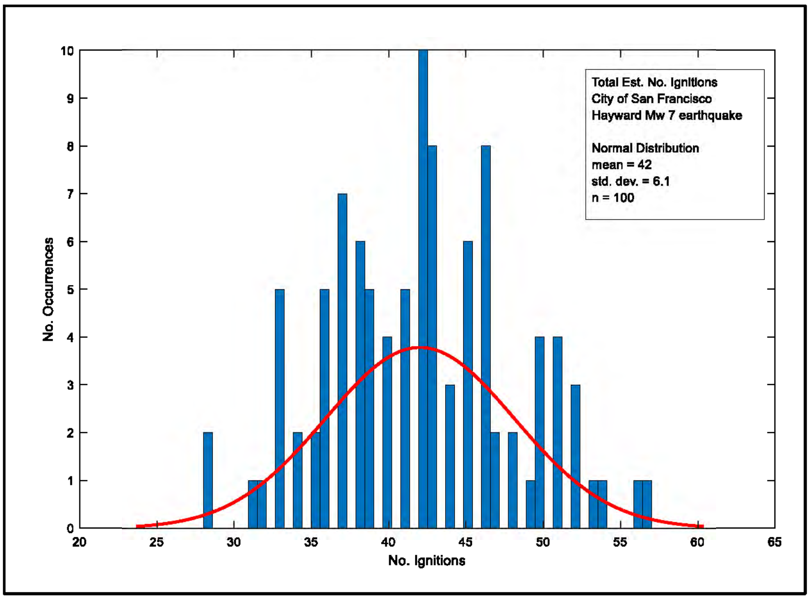


Figure 16 Histogram of estimated total number of ignitions for Mw 7 Hawyard event under current conditions. Current mean of 42 ignitions will grow to about 60 ignitions by 2050.

Number of ignitions grows with the City's population of course, and on average by 2050 will be about 160 for the San Andreas event and 60 for the Hayward event.

Required Water

Table 2 presents summary Required Water (flow in gpm and total volume in millions of gallons) and Burnt Total Floor Area (TFA, millions of sq. ft) for all 21 cases, for the 24th hour for the San Andreas Mw 7.9 event, and Table 3 similarly for the Hayward Mw 7 event.

Appendix section 5.3 presents similar results for hours 1, 2, 4, 8, 12 and 24. Also shown in both tables are the minimum and maximum values of all cases. Note that Table 2 contains results for a variety of conditions and for Phases 0 to 3, so direct comparison (and averaging) across all 21 cases is not valid, although comparison of two or more cases with similar conditions or Phases is valid.

As noted earlier in re the ground motions, the San Andreas event is far more severe than the Hayward event, and subsequent discussion here will only address the San Andreas event.

Table 2 Summary estimated Required Water demands (total water, millions of gallons) and flows (gpm), and total Burnt TFA, means, medians and 75th percentile, for 24th hour, for 21 cases

Case		Total Required Water Flow (millions gallons)			Required Water Flow (gpm)			Burnt TFA (millions sq ft)		
		median	mean	75%	median	mean	75%	median	mean	75%
1	SA7.9 Ph0 DLNCB	218	284	309	165,059	228,439	243,896	19	19	20
2	SA7.9 Ph0 DMNCB	176	225	266	131,445	180,384	218,535	18	18	20
3	SA7.9 Ph0 DHNCB	162	205	246	120,072	166,243	195,212	17	18	19
4	SA7.9 Ph0 NENCB	141	194	223	112,510	159,258	184,002	17	18	18
20	SA7.9 Ph1 NEYCF	143	205	256	112,621	167,254	202,586	25	26	27
22	SA7.9 Ph1 NENCF	161	209	241	128,048	169,887	202,599	25	26	28
48	SA7.9 Ph2 NEYCF	143	213	221	113,026	178,722	176,621	34	35	36
50	SA7.9 Ph2 NENCF	142	194	216	112,719	159,024	173,056	33	35	35
64	SA7.9 Ph3 DLYCF	216	282	340	165,368	233,123	274,085	48	49	52
65	SA7.9 Ph3 DLYAF	254	332	366	191,502	262,908	285,350	46	48	50
66	SA7.9 Ph3 DLNCF	198	276	317	154,152	226,830	255,097	46	49	51
67	SA7.9 Ph3 DLNAF	275	334	360	210,124	262,226	281,481	45	47	50
68	SA7.9 Ph3 DMYCF	155	233	269	124,100	194,487	210,338	43	45	48
69	SA7.9 Ph3 DMYAF	219	313	365	165,176	249,334	288,888	42	45	46
72	SA7.9 Ph3 DHYCF	140	192	232	108,835	160,093	188,237	42	44	46
73	SA7.9 Ph3 DHYAF	216	306	371	165,255	245,180	289,105	42	44	45
74	SA7.9 Ph3 DHNCF	136	204	245	105,150	170,313	191,507	42	44	46
75	SA7.9 Ph3 DHNAF	208	254	305	157,598	198,034	237,922	42	43	44
76	SA7.9 Ph3 NEYCF	150	215	241	120,181	180,760	198,990	42	44	45
77	SA7.9 Ph3 NEYAF	208	294	334	161,549	237,548	262,762	42	45	46
78	SA7.9 Ph3 NENCF	144	193	236	112,664	162,089	195,184	42	44	45
	Min all Cases	**136**	**192**	**216**	**105,150**	**159,024**	**173,056**	**17**	**18**	**18**
	Max all Cases	**275**	**334**	**371**	**210,124**	**262,908**	**289,105**	**48**	**49**	**52**

Figure 17 presents the timeline of estimated Required Water for Case 1 Ph0 DLNCB (San Andreas event) from the time of the earthquake to the 1500th minute (25th hour). It can be seen that median flow grows initially and then stabilizes at about 165,000 gpm as SFFD is fully committed, and that the median total amount of Required Water is about 218 million gallons. There is quite a bit of variation about these medians, as shown by the spread of the light gray lines (representing individual trials), with outliers several multiples of medians.

Figure 18 is for Case 72 Ph3 DHYCF (San Andreas event) – median flow is about 108,000 gpm and the median total amount of Required Water is now about 140 million gallons. That is, Required Water is less, despite population growth of 25%. Why? The EFWS now extends to all parts of the City and its operational efficiency is now High rather than Low (i.e., wider coverage, greater resilience, restores functionality faster, more rapid application of water on fire). SFFD capability is the same in both Phases. Improving SFFD's capability (Case 73 Ph3 DHYAF) results in more water usage but about the same total burnt area.

Following the figures are results for the Hayward scenario, Table 3. Comparable results and plots are provided for all Cases, for Required Water and a number of other parameters, in the electronic files.

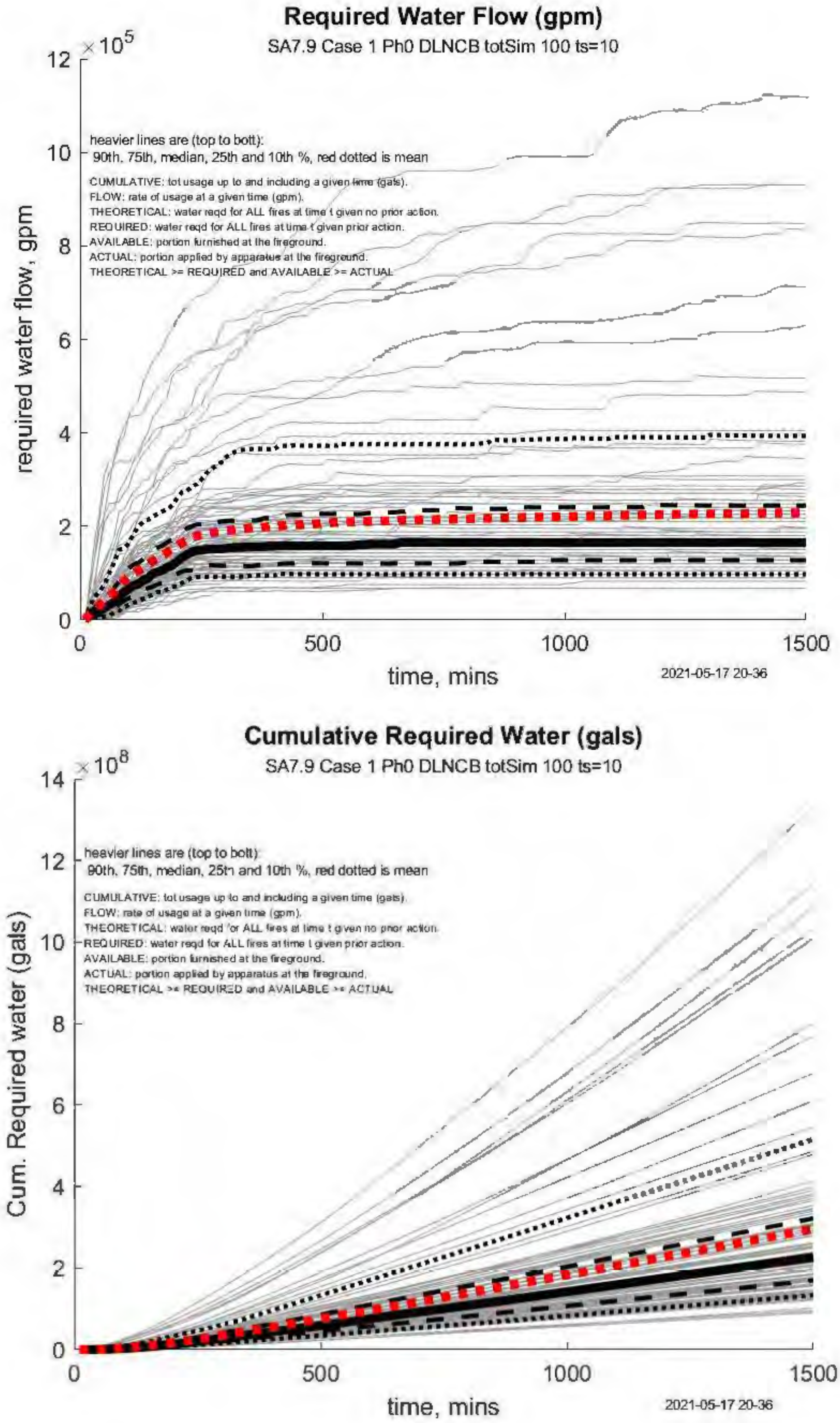


Figure 17 Case 1 Ph0 DLNCB San Andreas Mw 7.9 event current conditions estimated Required Water timelines: (top) water flow, gpm; (bott) total water required (gallons), from time of earthquake to 1500th minute. Heavy solid black line is median of 100 trials, dotted red is mean, dashed and dotted heavy black lines are 75th and 90th percentiles, and light gray solid lines are all 100 simulations.

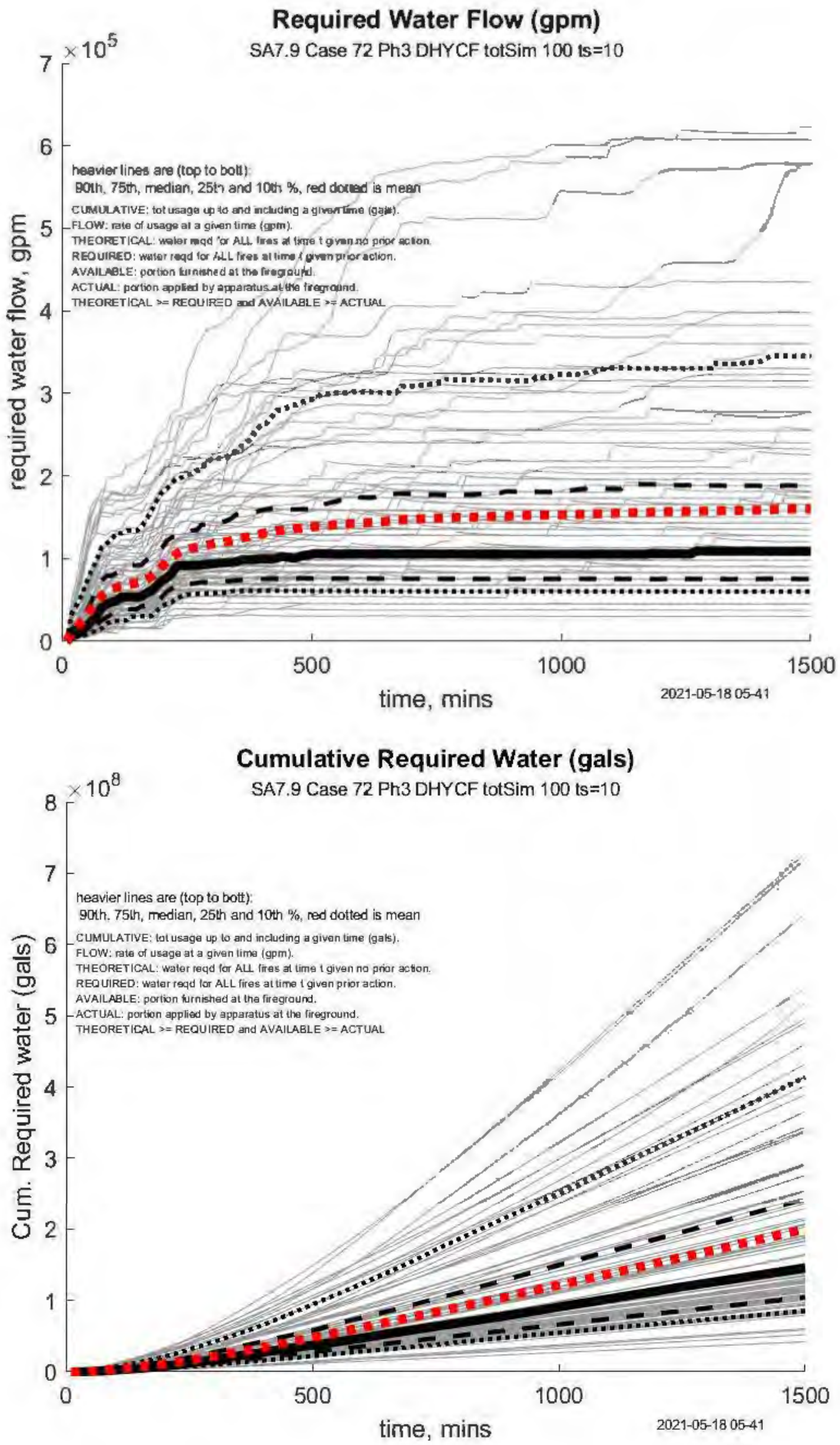


Figure 18 Case 72 Ph3 DHYCF San Andreas Mw 7.9 event current conditions estimated Required Water timelines: (top) water flow, gpm; (bott) total water required (gallons), from time of earthquake to 1500th minute. Heavy solid black line is median of 100 trials, dotted red is mean, dashed and dotted heavy black lines are 75th and 90th percentiles, and light gray solid lines are all 100 simulations.

Table 3 Summary estimated Required Water demands (total water, millions of gallons) and flows (gpm), and total Burnt TFA, means, medians and 75th percentile, for 24th hour, for 21 cases

Case		Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
		median	**mean**	**75%**	**median**	**mean**	**75%**	**median**	**mean**	**75%**
1	H7.05 Ph0 DLNCB	21	38	48	15,013	31,255	41,897	6	7	9
2	H7.05 Ph0 DMNCB	11	20	29	7,707	16,058	22,529	5	6	6
3	H7.05 Ph0 DHNCB	10	32	31	7,518	25,387	22,662	5	6	6
4	H7.05 Ph0 NENCB	10	27	40	7,540	22,335	30,065	5	6	6
20	H7.05 Ph1 NEYCF	19	45	50	15,011	36,615	37,500	9	10	12
22	H7.05 Ph1 NENCF	21	42	41	15,022	34,248	37,692	9	10	13
48	H7.05 Ph2 NEYCF	32	58	71	30,000	45,248	52,762	18	18	22
50	H7.05 Ph2 NENCF	38	68	78	30,005	55,465	60,009	18	17	22
64	H7.05 Ph3 DLYCF	63	104	127	48,873	79,984	97,637	30	30	35
65	H7.05 Ph3 DLYAF	57	88	107	41,442	71,182	83,318	30	30	33
66	H7.05 Ph3 DLNCF	73	109	132	60,007	85,505	108,963	31	31	35
67	H7.05 Ph3 DLNAF	50	79	91	37,696	63,664	67,585	30	29	33
68	H7.05 Ph3 DMYCF	59	102	140	45,190	80,284	113,948	28	28	33
69	H7.05 Ph3 DMYAF	50	90	111	37,604	69,738	86,269	28	27	31
72	H7.05 Ph3 DHYCF	60	102	133	45,167	80,181	101,264	28	28	31
73	H7.05 Ph3 DHYAF	40	82	108	30,072	64,857	82,530	25	26	30
74	H7.05 Ph3 DHNCF	51	97	109	41,375	76,808	90,151	28	27	31
75	H7.05 Ph3 DHNAF	41	72	83	30,133	56,278	63,988	26	26	29
76	H7.05 Ph3 NEYCF	60	92	116	45,068	72,299	90,715	27	27	31
77	H7.05 Ph3 NEYAF	50	75	97	37,686	61,132	82,501	28	26	30
78	H7.05 Ph3 NENCF	69	97	125	52,871	76,020	97,500	27	27	31
	min	**10**	**20**	**29**	**7,518**	**16,058**	**22,529**	**5**	**6**	**6**
	max	**73**	**109**	**140**	**60,007**	**85,505**	**113,948**	**31**	**31**	**35**

Discussion

The above has provided a glimpse of the large set of results from this study. This dataset provides rich detail, which is discussed at more length in Appendix section 5. A few observations:

- Figure 19 shows the median and 75th % Required Water flow (gpm) averaged across all cases. Averaging over all cases mixes many things, including the different phases of EFWS buildout, so that the figure is only of limited value. Nevertheless, it can be seen that the Required Water flow is several times current capacity.
- Figure 20 parses Figure 19 by Phase of EFWS building, finding that 75th % Required Water demand remains about the same or slightly decreases from current conditions (Phase 0) through 2050, despite the City's very significant projected population growth during this period.
- It is of interest to compare the current study's results with those provided in 2012 for CS-199. Comparison is difficult due to the 2012 results being for only the first 120 minutes, not considering fire department response etc, but Figure 21 provides some useful insight – in summary, this study's results at minute 60 are somewhat less than the results in 2012 due to this study considering fire department response (and 2012 not doing so), but after that time the general trend of the 2012 study is in line with this study's results.

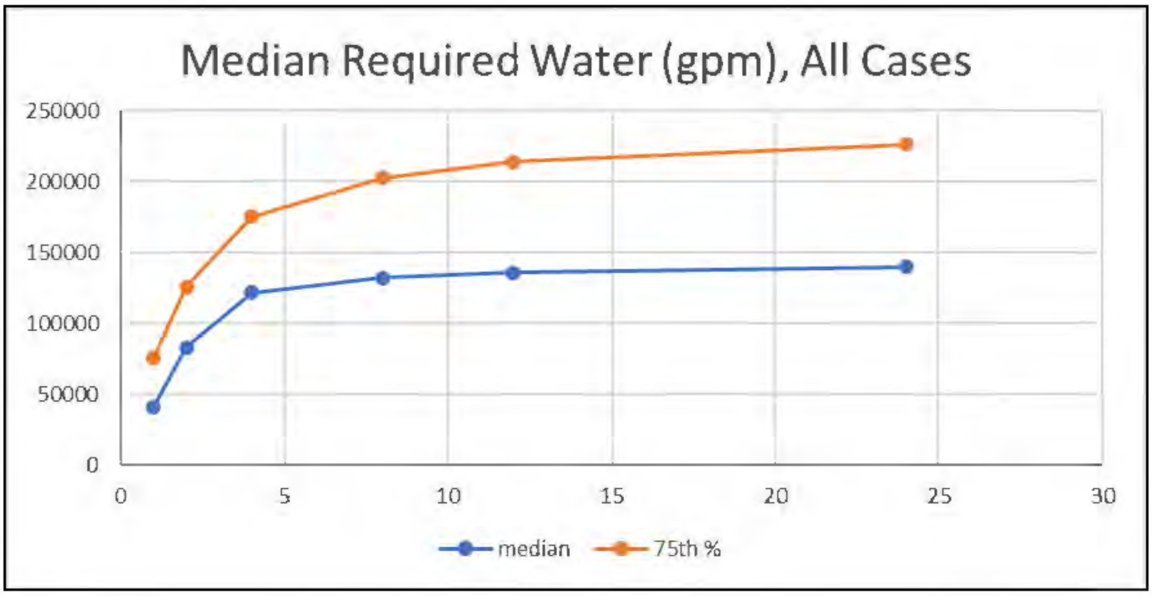


Figure 19 Median and 75% estimated Required Water flow (gpm), averaged over all Cases

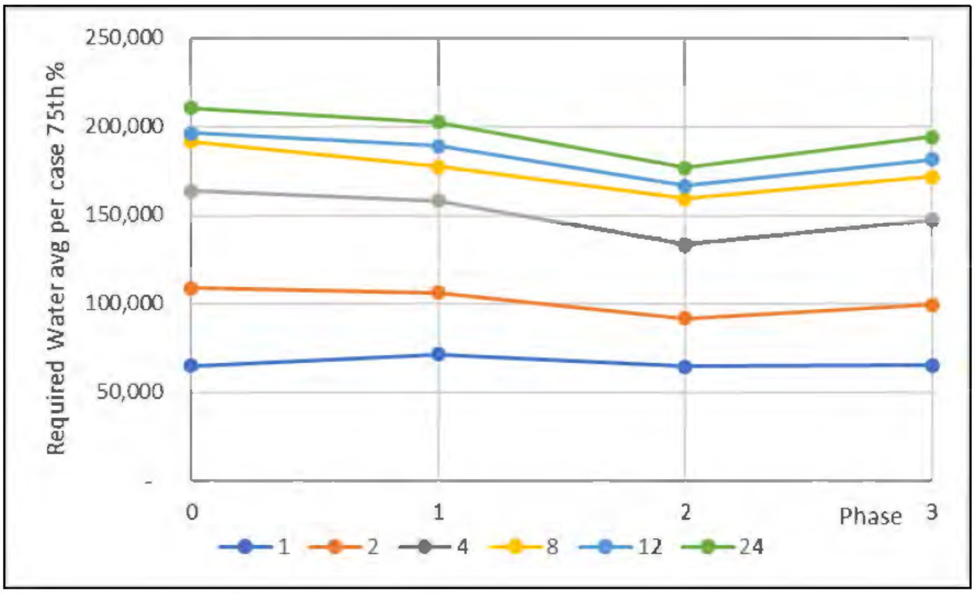


Figure 20 Variation of estimated Required Water demands vs. Phases, for hours 1, 2,4, 8, 12 and 24. In all cases, demand modestly decreases despite City's significant growth of population.

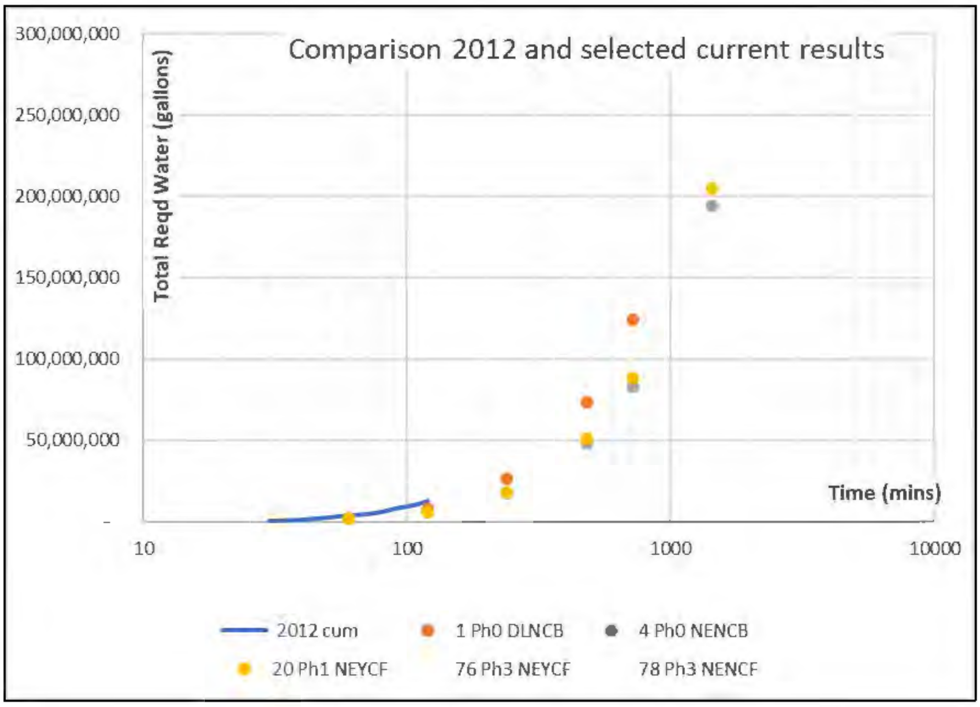


Figure 21 Comparison of estimated water demands from 2012 analysis (solid blue line) vs. selected current estimates (points). The 2012 analysis (see Appendix D) was only for the first 2 hours and had several limitations. The current estimates are selected cases – see text for description. The overall trends are (a) water demands increase exponentially with time; (b) there is relatively little variation in water demands no matter what the Phase is, or assumptions regarding system damage and operation; (c) the 2012 results, although limited, appear to have the same trend as current estimates.

Concluding Remarks

Water demands for fighting fires following a major earthquake affecting San Francisco have been estimated based on a detailed model of fire service operations and water system performance. The model employs several large datasets, including data for each building in the City, detailed ground motion models, hourly weather data, tree canopy data, pipe network data and other data. Uncertainty on many of these data is considered in the analysis.

A key point emerging from the analysis is that effective suppression of fires following a major earthquake requires a balance of fire service and water supply resources – that is, copious amounts of water are superfluous if the fire department's resources are not adequate to the task, and conversely an abundance of fire department resources is largely useless if the water supply isn't adequate to the task. Moreover, rapid and adequate fire department response with adequate water readily available at the fireground greatly reduces the total water demand.

Regarding water requirements, under current conditions, the first 25 hours following a major earthquake are estimated to require 200+ million gallons of water provided to firegrounds for effective firefighting. This demand can be reduced or remain about the same through 2050, depending on EFWS improvements and SFFD capability. Further study is probably required to determine how SFFD can most effectively use this water.

The fundamental result is that depending on Case, estimated Required Water flow will be 100,000 to 200,000 gpm in the median, and 200,000+ gpm at the 75th percentile. It is important to understand that the system should be designed for an upper percentile of required flows, rather than the median – if designed for the median, then by definition 50% of the time flows will be inadequate for fire suppression, thus an upper percentile should be a design target. Figure 17 shows that the 75% flow is about the same as the mean (i.e., arithmetic average) flow, at about 230,000 gpm, while the 90th percentile flow is over 300,000 gpm. Designing for the 75th percentile is equivalent to having sufficient water for fire suppression in 3 out of 4 repetitions of the scenario event.

What does 200,000 gpm mean in physical terms? Well, to use a popular measure, an Olympic size swimming pool[3] would be filled in 3 minutes at this rate. Or, Twin Peaks Reservoir (10 million gallons) would be emptied in 50 minutes.

More relevantly, if all 43[4] SFFD first line and 7 reserve engines (i.e., total of 50 engines), and all three Fireboats (Pheonix,10,000 gpm; Guardian, 22,000 gpm and St. Francis, 18,000 gpm, all at 150 psi) and both EFWS Pump Stations (two at 10,000 gpm each, at 150 psi), are all pumping at full capacity, the total is 144,600 gpm[5]. If the 75th percentile is the goal, the shortfall of 200,000 – 144,600 = 55,400 gpm might be provided by Twin Peaks Reservoir for 180 minutes. This capacity is useful if the EFWS can convey all this water to the fireground.

However, "if the EFWS can convey all this water to the fireground" is the issue. At present, the EFWS ability to convey large amounts of water to some locations is limited by the pipe sizes leading to those locations and, in any case, the EFWS doesn't currently extend to all parts

[3] Defined as 25m x 50m x 2m equivalent to 660,000 gallons.

[4] Apparatus on Treasure Island and at San Francisco International Airport are not included.

[5] Note that this is only for illustration and its simple addition involves double counting since if fire engines are drawing from the EFWS then their pumping capacity is against and not in addition to the pumping capacity of the fireboats or pump stations.

of the City. In those parts of the City not covered by the EFWS, there are a significant number of cisterns. However, the effective radius over which a cistern provides protection is only a few blocks. Hose tenders extend this radius, and SFFD is in the process of acquiring a larger number of modern hose tenders.

In conclusion, depending on the expansion of the EFWS and capacity of SFFD, there may or may not be adequate amounts of water at some fires when fire engines arrive, which would lead to continued fire growth and a larger demand for firefighting water than at first arrival. The analysis has considered this in the various Analysis Cases and estimation of Required Water.

Appendices to this report provide additional detail.

APPENDICES

1 INTRODUCTION

The project purpose, background and scope of work are presented.

1.1 PURPOSE

The purpose of this project has been the estimation of water required to suppress fires following a major earthquake affecting the city of San Francisco. Estimating the required water assumes all fires are fought by the San Francisco Fire Department (SFFD) with aid from other fire departments some time following the earthquake. Estimation of required water is needed to determine if the current water supply sources and conveyance infrastructure meet the requirements for firefighting, or if additional sources and infrastructure are required.

1.2 NOMENCLATURE

The many specialized terms and abbreviations used in this report are defined in the Table of Abbreviations and Acronyms, but a few terms are worth discussion:

The **Emergency Firefighting Water System (EFWS)** refers to the aggregation of the high-pressure network[6], PEWFS and other pipelines, connections to reservoirs, pump stations and infrastructure planned to protect the city from major fires. The high-pressure network is an earthquake-resistant pipe network and facilities built following the 1906 San Francisco earthquake and includes not only the pipe network but also the Twin Peaks 10-million-gallon reservoir, Pump Stations 1 and 2, and other critical equipment including cisterns, fireboat manifolds and other appurtenances. The original pipe network protected the Central Business and nearby districts and in subsequent decades was extended to the Mission and other areas. Future pipes and appurtenances connected to the current network (e.g., Infirm Area backbones, Presidio line, lines in southern part of city) are included unless otherwise noted.

The **Potable Emergency Water Firefighting System (PEWFS)** is a new system in the planning stage that will protect the Richmond and Sunset districts. It will consist of a pipe network from Lake Merced northwards to the Richmond and connecting to Sunset Reservoir, with pump stations at Lake Merced, Sunset Reservoir and perhaps at Sunset Pumping Plant. It will be operated as a potable trunk line supplied from Sunset Reservoir under normal conditions and switched to a high-pressure network (independent of the current high) for firefighting when needed. When operating as a high-pressure network PEWFS if required may inject raw water from Lake Merced.

1.3 Background and Scope of Work

During 2011-2014 the San Francisco Public Utilities Commissions and its consultant AECOM/AGS JV reviewed the existing EFWS high-pressure pipe network and made recommendations on pipelines, control systems, seawater intake tunnels, and cisterns to optimize benefits from repairs and improvements to the network, given the potential for seismic activity in the area (CS-199 2014). As part of that work estimates were made of the water required for post-earthquake firefighting (Scawthorn 2012). These estimates had several limitations – (a) they were based on early 2000s data that had been employed for the previous CAPSS study (ATC-52-1 2010), (b) they were only for the first 2 hours following the earthquake, (c) they did not take into account SFFD firefighting response (and were thus an

[6] The high-pressure network was termed the Auxiliary Water Supply System (AWSS) but is now part of the larger EFWS

overestimate of water requirements) and (d) they were a “snapshot” of needs in July 2012 as opposed to what the needs of the city would be in the future.

Because the estimates left room for improvement, discussions with SFPUC in late 2018 resulted in agreement on a scope of work for updating the fire following earthquake water demands, termed the Fire Following Earthquake Water Requirements Study project (FFEWRS). To avoid frequent future updates of these results, it was decided to make projections of future San Francisco growth through 2050 and provide estimates of firefighting water needs at several future stages or “phases” of infrastructure buildout. The specific scope of work consisted of the following tasks:

1. “Project initiation and work plan: this is a modest task to meet with SFPUC and present the project work plan. The work plan will be based on this scope of work, with actual schedule dates and specific meetings, and identification of needed SFPUC liaison with other departments. Deliverable: Document the task and results in a Technical Memo.
2. “Kickoff and stakeholder input: this task consists of one to several meetings with stakeholder City agencies to outline the project and receive stakeholder input. If possible, a workshop will be held to facilitate simultaneous input from multiple stakeholders. Deliverable: Document the task and results in a Technical Memo.
3. “Collect and review San Francisco exposure and growth data: Working with SFPUC personnel, arrange and attend meetings with relevant persons in San Francisco PUC, Planning Department and Fire Department, to identify and receive relevant future growth projection data. If deemed useful, meet with Metropolitan Transportation Commission and other agencies (e.g., ABAG) for similar purposes. Included in this task is collection of data related to exposures in city parks (e.g., Golden Gate, McLaren and other parks) and in the Presidio (to be confirmed). Review and employ this data to develop LMH growth projections. This task will include receiving most current building stock inventory from the Planning Department. Deliverable: Document the task and results in a Technical Memo.
4. “Data processing and preparation: with approved LHM projections, building stock projections will be developed and prepared for use in the fire following earthquake model. This is a project internal task and no TM will be prepared.
5. “Seismic hazard: this task will review current seismic hazard estimates affecting San Francisco, to assure up-to-date ground motion data will be employed (the ground motion estimates employed in 2012 are out of date). Two major seismic events will be considered: an Mw 7.9 event on the San Andreas fault similar to the 1906 event, and a Mw 7 event on the Hayward fault (based on the recently published Haywired study. The question of whether and how to include effects of aftershocks will be addressed. To account for uncertainty, ground motions will be characterized in a suite of hazard maps, probably using the method of Miller and Bakeriii. Deliverable: Document the task and results in a Technical Memo.
6. “Analysis and post-processing: this task consists of estimating ignitions, corresponding fire department response and water requirements for typical seasonal weather conditions, for city block other areas in the contiguous portion of San Francisco county, for one-minute steps for the first two hours following the earthquake. Effects of

vegetation in city parks and the Presidio will be considered. This task does not require a TM.

7. “Results delivery and report: Data on water demands will be delivered in a format like that employed in 2012, together with a Report documenting the methods and data employed. The Report will provide guidance on use of the data, including given actual growth data available in the future. Deliverable: Document the task and results in a final project Report.
8. “Project management: This is a modest task consisting of project management, status reports and related activities. “

The Fire Following Earthquake Water Requirements Study project (FFEWRS) began and was amended in October 2019 for two tasks regarding optimization of the pipe network.

2 SAN FRANCISCO, ITS EARTHQUAKE RISK AND THE EMERGENCY FIREFIGHTING WATER SYSTEM

San Francisco's development, seismicity, fire following earthquake risk and infrastructure for mitigating this risk are provided as background and context for this study. These topics are not addressed in depth, and the reader is referred elsewhere for more detail.

2.1 San Francisco and its development

Prior to the Gold Rush, San Francisco was hardly a village, with a population of just a few hundred. Even after 1849, while growth was rapid, the City hardly extended beyond today's Financial District, Figure 22, although the density of construction was rather high, Figure 27. Much of the rapidly expanding city was built of wood, which led to a number of conflagrations in the 1850's and a vigilance against fire that continued thereafter. By the turn of the century, San Francisco had grown to a population of 400,000, with a major fire risk, Figure 23.

A survey of San Francisco 1905 by the National Board of Fire Underwriters (NBFU 1905) provides a detailed snapshot of the city, whose built-up extent is shown in Figure 24, while Figure 25 shows the western portions (today's Richmond and Sunset districts) were still sand dunes. The grew rapidly and was largely built out by WW2, with only a few remnant sand dunes remaining, Figure 26.

Figure 22 San Francisco 1857
Source: US Coast and Geodetic Survey map, David Rumsey Map Collection www.davidrumsey.com

Figure 23 San Francisco 1905

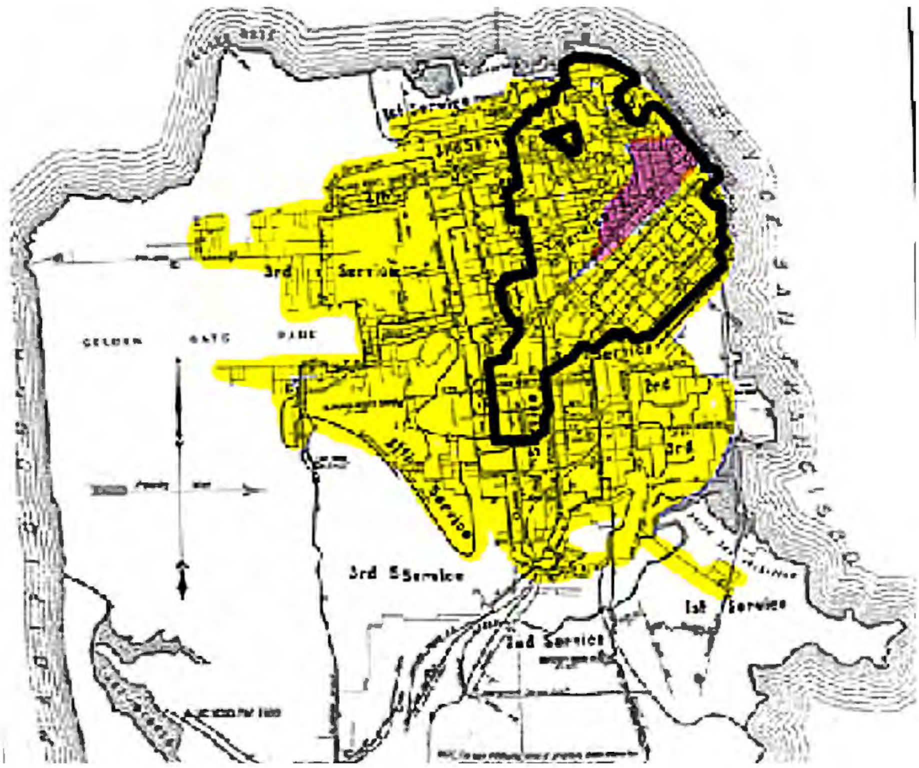


Figure 24 San Francisco water distribution network, 1905
– built-up area shown in yellow and congested area in pink, outline of 1906 burnt area in black
Source: adapted from (NBFU 1905)

Figure 25 San Francisco 1905 – note sparsity of buildings N and S of Golden Gate Park
Source: US Coast and Geodetic Survey map, David Rumsey Map Collection www.davidrumsey.com

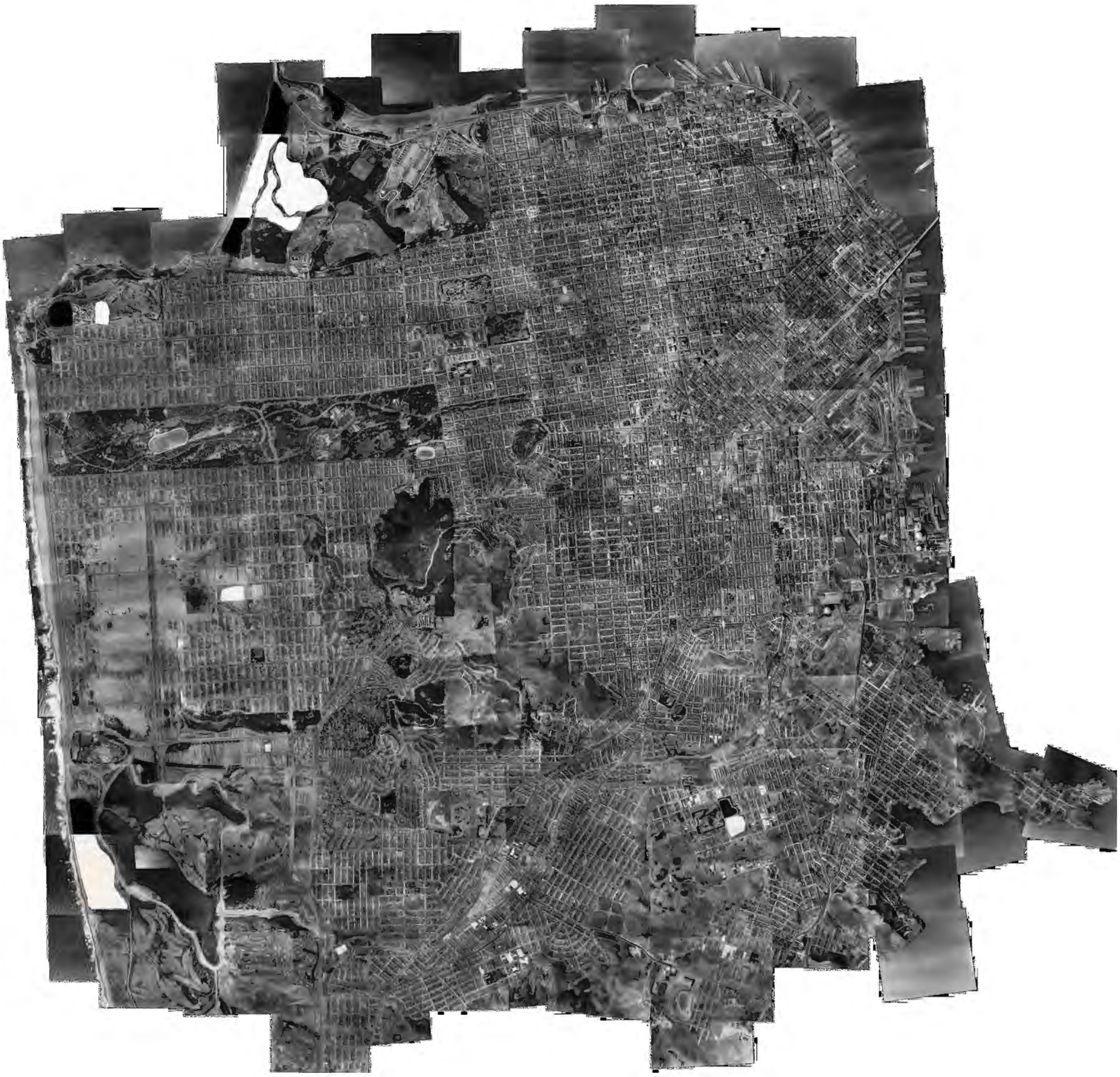


Figure 26 San Francisco composite aerial views by H. Ryker, 1938. City is almost entirely built out with remnant sand dunes in Sunset District west of Sunset reservoir
Source: David Rumsey Map Collection www.davidrumsey.com

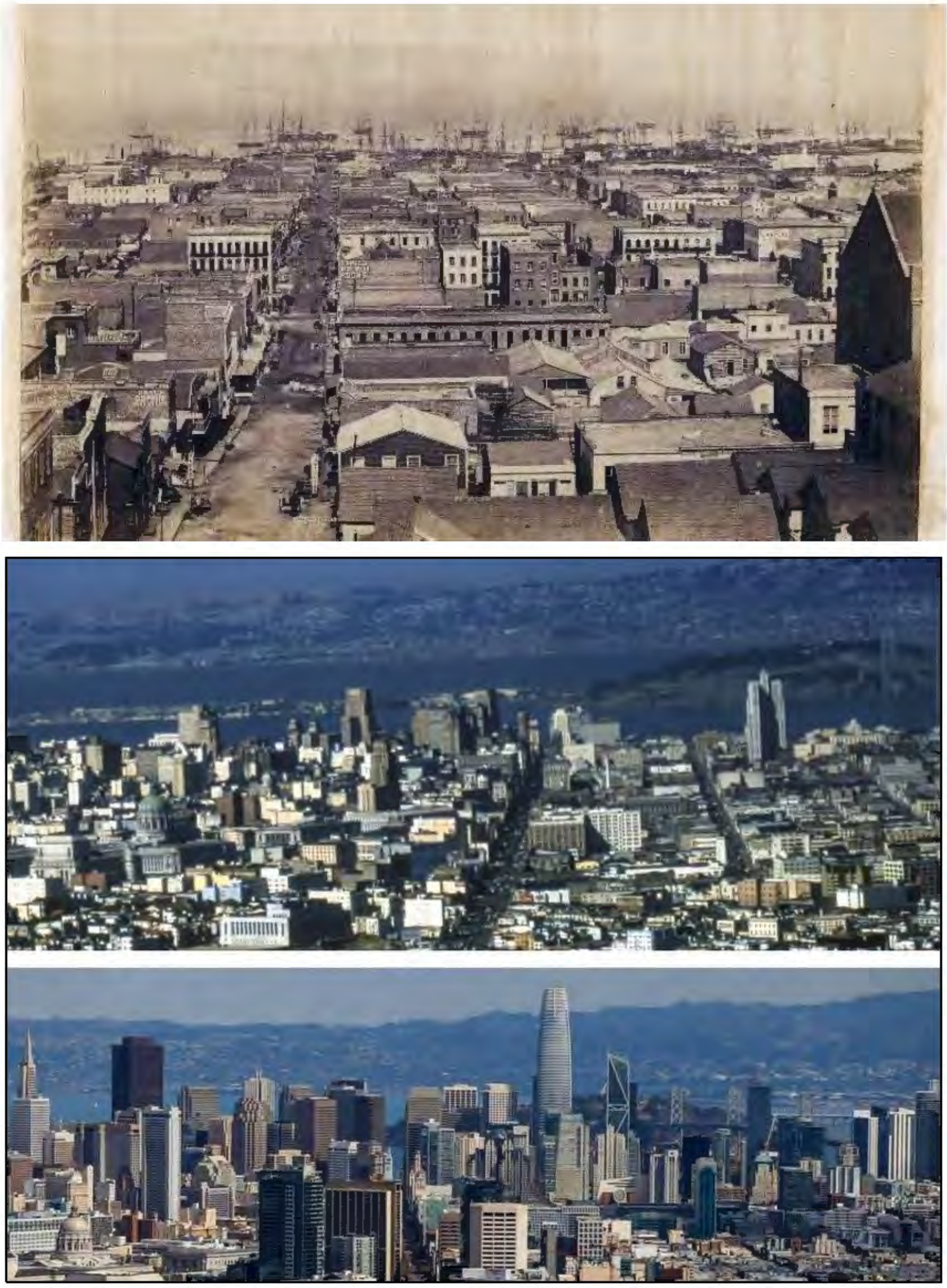


Figure 27 San Francisco: 1856, 1954 and 2018

Sources: https://sf.curbed.com/maps/old-photos-photographs-san-francisco-gold-rush and https://www.sfgate.com/bayarea/article/san-francisco-tallest-buildings-skyscrapers-height-13532960.php#photo-16804791

The rapid growth of San Francisco, continuing today, is clearly shown in Figure 27 and Figure 28. While many new high-rises have risen downtown, and there's been some densification in residential areas with multi-family buildings replacing single-family homes, by number much of San Francisco's buildings pre-date WW2 (67%) and even pre-1906 (13%), while 94% of all buildings are of wood construction (ATC-52-1 2010), Figure 2.

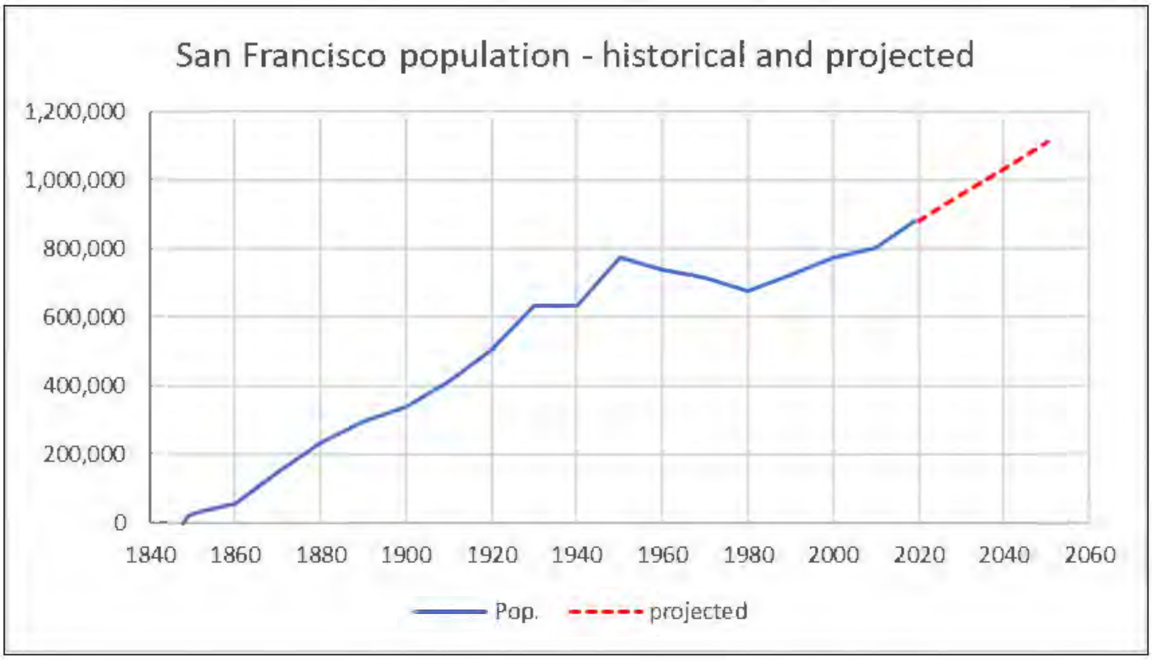


Figure 28 San Francisco historical and projected population by decade

2.2 SAN FRANCISCO'S SEISMIC HAZARD

There is not much need to dwell on San Francisco's earthquake risk – it's well known and real. The city is athwart the North American – Pacific plate boundary, with the San Andreas fault and the Hayward faults 10 miles equidistant from the Ferry Building, Figure 29. Virtually all of the city has the potential for very strong ground shaking, with USGS for the next 30 years estimates being 72% for a Mw 6.7, 51% for a Mw 7.0 and 20% for a Mw 7.5 event in the Bay Area, Figure 30.

Based on a review of seismicity, this study employs two scenario earthquakes: (1) a Mw 7.9 event on the San Andreas fault like the 1906 event, and (2) a Mw 7.05[7] event on the Hayward fault in the East Bay. These two events were also examined in the CAPSS study (ATC-52-1 2010). Ground motions for these events is discussed in section 3.2.3 but it should be noted that the ground motions from either of these events will be very strong in San Francisco, with the Mw 7.9 San Andreas event being generally stronger, especially in the western portions of the City, which are only a few miles from that fault. The Hayward event, while generally having similar or smaller ground motions than the San Andreas event, is considered more likely to occur in the near future.

[7] The two digit precision for the Hayward event is due to the USGS Haywired project (Detweiler, S.T., and A.M. Wein (Eds.). 2017. *The HayWired earthquake scenario—Earthquake hazards (ver. 1.1, March 2018):*. Washington: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, available at https://pubs.er.usgs.gov/publication/sir20175013v1. Such precision for earthquake magnitude is somewhat illusory, and hereafter the Hayward event magnitude will be denoted at Mw 7.

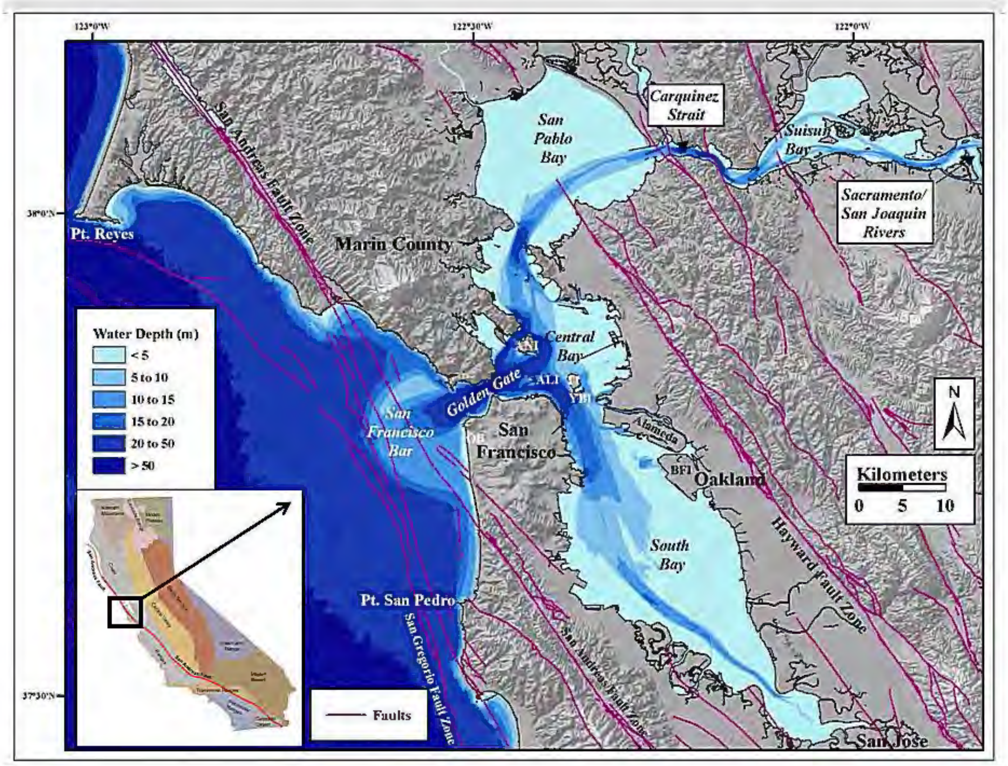


Figure 29 Bay Area map with shaded relief and faults in magenta. Inset is the state of California main geomorphic figures, particularly the San Andreas fault shown in red.
Source: adapted from (Johnson and Bartow 2018) who source it as (Barnard et al., 2013)

Figure 30 USGS estimated event probabilities 2014-2043

Geology strongly influences earthquake ground motions, and the city has large areas of very soft soils in what was once the Bay or marshes, and virtually the entire western half of the city being on what were a century ago sand dunes, Figure 31.

Figure 31 Geologic map of San Francisco illustrating Quaternary units (Graymer et al., 2006). Franciscan Complex Bedrock is not shown. Units include: Gray= Artificial Fill (AF), Pink= Landslide and hillslope deposits (Qsl), Yellow = Sand dunes (Qd), Orange = Colma Formation (Qc), green = older Quaternary Alluvium (Qpa); Merced Formation = light blue. Also shown is location of the shoreline in 1850 (blue dashed line) and the extent of historic marshes from 1898 (blue cross hatch pattern) Note: Young Bay mud is covered by artificial fill in San Francisco.
Source: (Johnson and Bartow 2018) who source it as (Sowers et al., 2007)

2.3 SAN FRANCISCO AND FIRE FOLLOWING EARTHQUAKE

Nineteenth century urban America was a very flammable place – for example conflagrations in nine different cities from 1835 to 1905 each involved the destruction of at least 1,000 buildings (TCLEE 2005). San Francisco was no exception, with several conflagrations in its early years[8], and an appreciation by 1905 that there was a very high risk of a major conflagration. In that year, the city was rated by the National Board of Fire Underwriters (NBFU, 1905) who found its fire department efficient, well organized and, in general, adequate. The NBFU however concluded that

> "...In fact, San Francisco has violated all underwriting traditions and precedent by not burning up. That it has not done so is largely due to the vigilance of the fire department, which cannot be relied upon indefinitely to stave off the inevitable."

Prophetic words, indeed.

2.3.1 Comparison of 1906 and today

It is worth comparing the situation in 1906 and today. The San Francisco Fire Department in 1905 protected approximately 400,000 persons occupying an urbanized area of approximately 21 square miles, Figure 24. The department consisted of a total of 585 full paid fire force personnel (resident within the city and on duty at all times), commanded by Chief Dennis T. Sullivan and deployed in 57 companies (38 engine, 1 hose, 10 ladder, 1 hose tower, and 7 chemical) (NBFU, 1905). The distribution of these companies was well conceived, being centered about the congested high value district (i.e., the Central Business District or CBD, known in San Francisco as the Financial District), with 24 engine, 8 ladder, 1 water tower and 7 chemical companies within 2 miles of the center of the CBD. All but two of the 38 steam engine companies dated from 1890 or later and were rated at an average of 680 gallons per minute (gpm), although the eight engines tested in 1905 averaged only about 70% of their rated capacity, and the "*ability of the men handling the engines was in general below a proper standard*". The rated pumping capacity of the 38 first line and 15 relief and reserve engines totaled 35,100 gpm. Table 3 shows this SFFD capacity in 1906 and today (many specialized types of apparatus are omitted).

Table 4 SFFD on duty staffing over the years

Year	Engines	Pumping Capacity (gpm)		Ladder trucks	Total Fire Personnel	Total On-duty Fire Personnel[9]
		Tot.	Per thous. popul.			
1906	38	35,100	88	16	585	585
2020[10]	43 + 5 R	72,000	82	20	1449	268

[8] "Several" is an understatement: Two multi-building fires in 1849, one of which caused a million dollars in damage; 4 in 1850 with one causing $4 million in damage; and two in 1851, one causing $12 million and another $3 million in damage (http://sfmuseum.org/hist1/fire.html).

[9] All personnel in 1906 resided in San Francisco and were on-call at all hours if needed. Today, many firefighters reside outside the City.

[10] Engine count includes 5 reserve engines, does not include Treasure Island or San Francisco International Airport. Pumping Capacity in 2020 based on 1500 gpm per engine.

2.3.2 1906 earthquake and fire

One of the largest earthquakes to strike North America occurred at 5:12 AM on April 18, 1906. Much has been written about it, and only a brief review is presented here.

Within moments after the earthquake, Chief of Department Dennis T. Sullivan was fatally injured due to a neighboring building collapsing onto the fire station where he was sleeping – he lingered for four days. Ten fire stations sustained major damage (Tobriner, personal communication) although the earthquake did not seriously damage any engines, which all went into service (Reed 1906). Street passage was in general not a problem, and a number of fires were quickly suppressed, although many more could not be responded to. The NBFU (Reed 1906) reported that:

> "…fires in all parts of the city, some caused directly by earthquake, some indirectly, prevented an early mobilization of fire engines and apparatus in the valuable business district, where other original fires had started and were gaining headway".

The numbers of fires and/or explosions after the earthquake have been estimated as between 50 (Reed 1906) and 52 (Scawthorn and O'rourke 1989), Figure 32

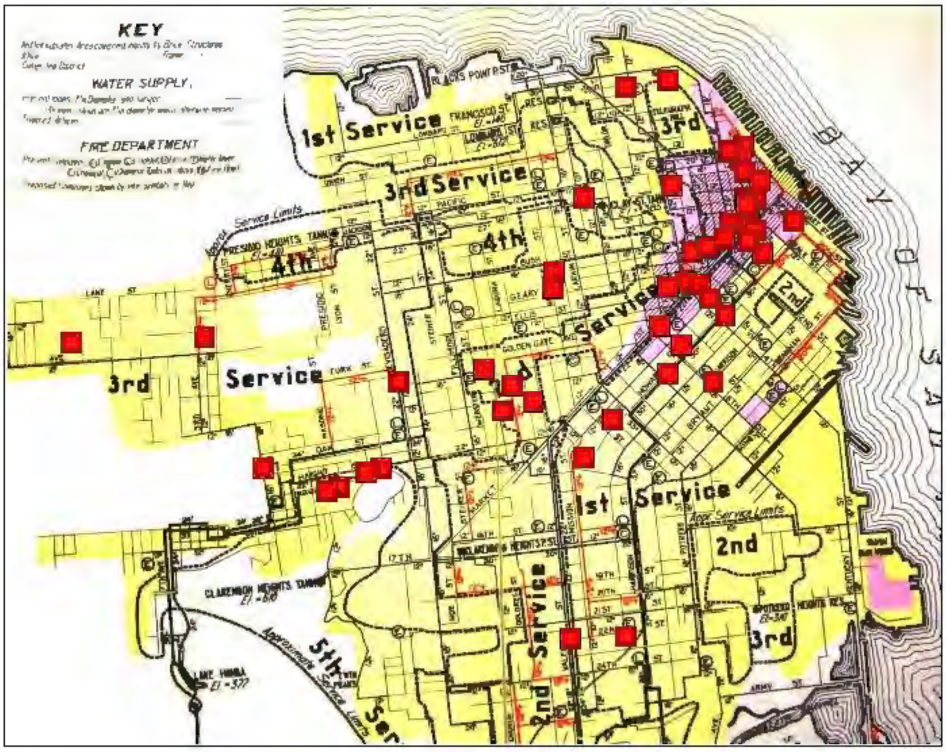


Figure 32 San Francisco in 1906: Black lines are 8 inch and larger water mains (thicker the line, larger the diameter). Yellow area is primarily wood frame construction, while pink is primarily masonry – crosshatched pink area downtown is the 'congested area' – that is, the Central Business District. Ignitions following the 1906 earthquake are shown as red squares. (adapted from NBFU, 1905)

The NBFU concluded that even under normal conditions the multiple simultaneous fires would probably have overwhelmed a much larger department, such as New York's, which had three times the apparatus. Nevertheless, Bowlen (see Scawthorn and O'Rourke, 1989) concluded that by 1 PM (i.e., about 8 hours after the earthquake)

> "the fire department, except that it was without its leader, was in fairly good shape, that is the men and horses were in good trim for firefighting, the apparatus was in shape and could be worked where there was water. There is not one report of an engine or man going out of commission during the early hours of the fire, and the department was hard at work all the time, even though there was little to show for its effort"

The final burnt area is shown in Figure 33.

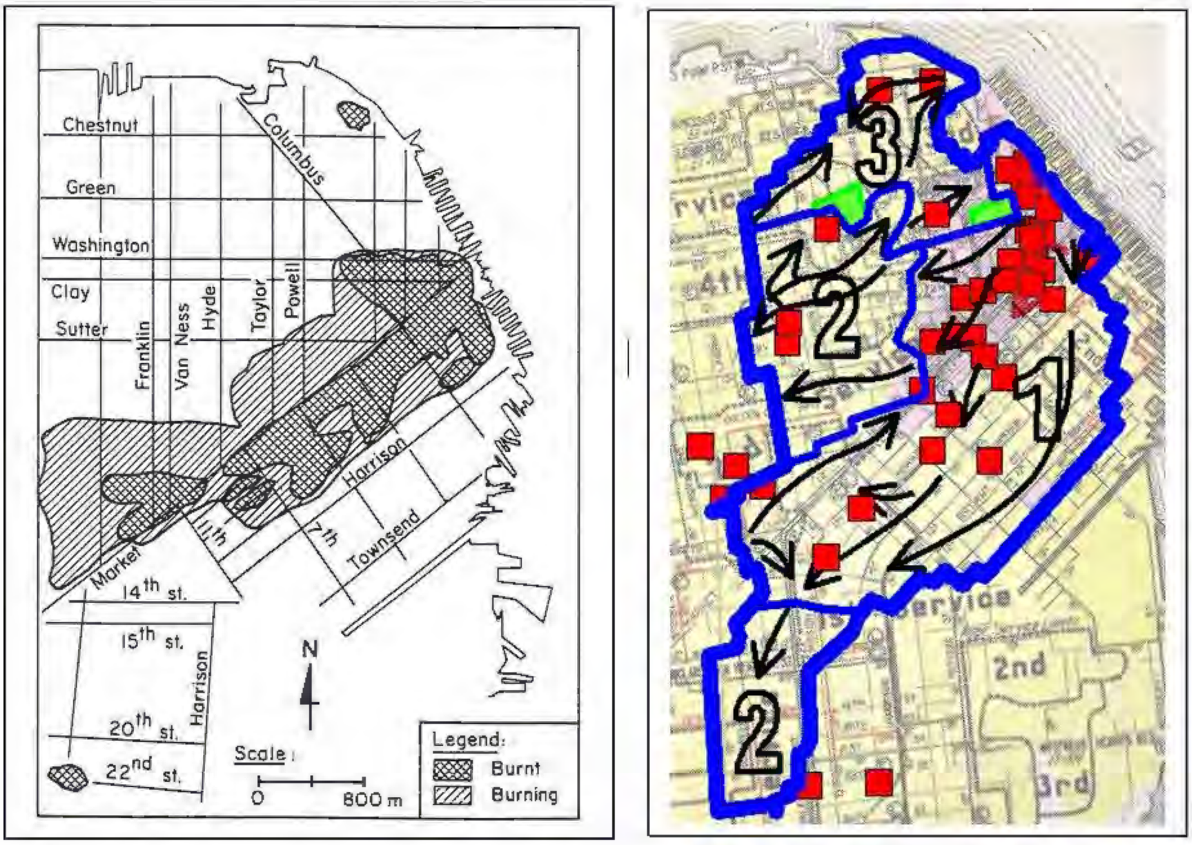


Figure 33 (left) Fires at about midnight April 18 (Source: Scawthorn and O'Rourke, 1989); (right) Final burnt area outlined in heavy line – arrows show fire path of fire spread, with general areas burned in days 1, 2 and 3/4 indicated by numerals and divided by thinner lines. Green areas were not burnt.

2.3.3 1906 earthquake and water supply

The real impairment was not to the fire department but to the water service. At the time of the earthquake, there was a combined volume of 88.7 billion liters in San Francisco's reservoirs on the San Francisco Peninsular. Within the city limits, there were approximately 711 km of distribution piping at the time of the earthquake, of which roughly 18,5 and 66.5 km were wrought and cast iron trunk lines, respectively, mostly constructed during the years of 1870 to 1906. Figure 24 shows the 1906 water supply within the San Francisco City limits, where nine reservoirs and storage tanks provided a total capacity of 354 million liters. All trunk lines, 400 mm or larger in diameter, are also plotted, as well as zones of lateral spread caused by soil liquefaction.

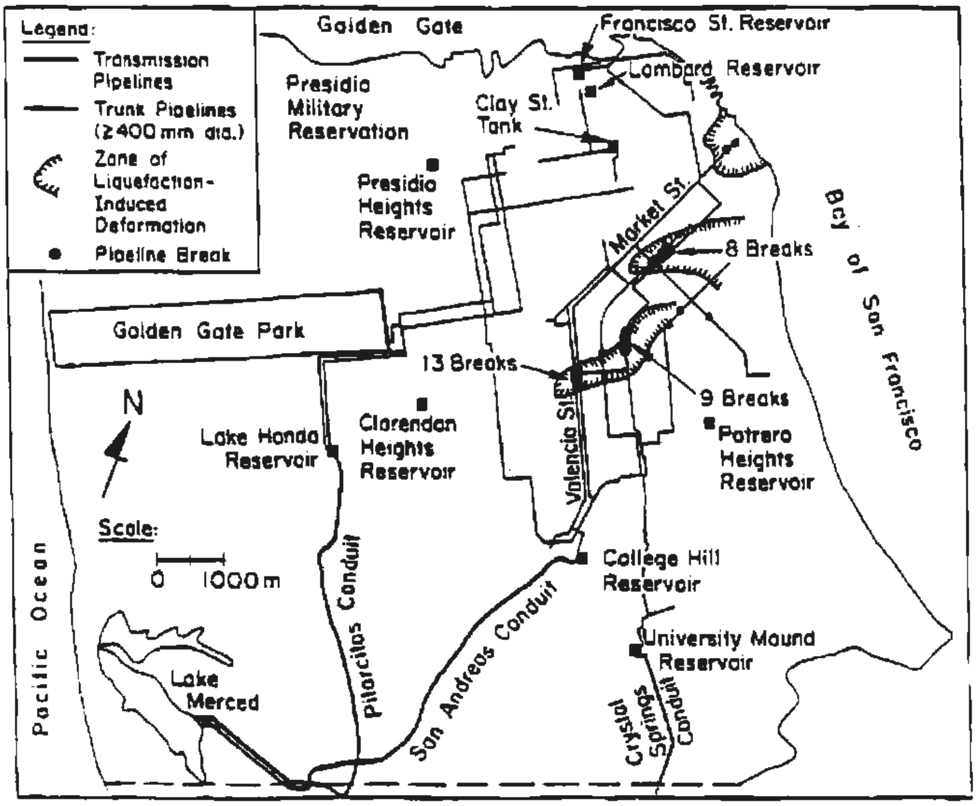


Figure 34 San Francisco Water Supply and effects of permanent ground deformation (Scawthorn and O'rourke 1989)

It can be seen that multiple ruptures of the pipeline trunk systems from the College Hill and University Mound Reservoirs occurred in the zones of large ground deformation, thereby cutting off supply of over 56% of the total stored water to the Mission and downtown districts of San Francisco. Liquefaction induced lateral spread and settlement ruptured two pipelines, 400 and 500 mm in diameter, across Valencia Street north of the College Hill Reservoir, which emptied the reservoir of 53 million liters, thereby depriving fire fighters of water for the burning Mission District of San Francisco. With the College Hill and University Mound Reservoirs cut off, only the Clay Street Tank and the Lombard and Francisco Street Reservoirs were within the zone of most intense fire, and therefore capable of providing water directly to fight the blaze. The combined capacity of these reservoirs was only 21 million liters, or 6% of the system capacity The usefulness of such limited supply was further diminished by breaks in service connections, caused by burning and collapsing buildings. Schussler identifies service line breaks as a major source of lost pressure and water. There were roughly 23,200 breaks in service lines, between 15 and 100 mm in diameter. Fallen rubble and collapsed structures often prevented firemen from closing valves on distribution mains to diminish water and pressure losses in areas of broken mains and services.

The spatial relationship between unburnt districts in San Francisco and availability of water implies that pipeline system integrity played a key role in limiting the spread of fire, and that areas suffering from ruptured pipelines fared poorly. This inference must be made with caution, however, since the development of the fire south of Market by mid-afternoon had resulted in a burning perimeter or flame front on the order of 7.5 km. Effective defense along this flame front would require on the order of one to two hundred handheld lines, or virtually the entire steam engine force of the fire department. Even if effective, this ignores branding (i.e., fire spread by burning debris, flying over defense lines and causing fires behind the fire line) and does not consider whether the water supply system, if intact, could have furnished the required water (25,000 to 50,000 gpm). Even if this defense had held, the firefighters, fully occupied south of Market, would have been outflanked by the "Ham and Egg fire "[11], which did indeed sweep down from the west during the second period, outflanking the defending line along Market.

Figure 35 presents a bar graph showing the reservoir storage in San Francisco as a function of time after the earthquake. The amounts of water corresponding to Day 1 represent the quantities available roughly two hours after the earthquake struck. After four days, less than one-tenth of the initial capacity of the College Hill, University Mound, and Lake Honda Reservoirs still was available. Two factors were critically important in preserving flow. Sixteen hours after the earthquake, water was pumped from Lake Merced into the Pilarcitos Conduit to supply Lake Honda. This action provided an additional 25 million liters/day, thereby maintaining capacity in Lake Honda for distribution to the western parts of the city. After repairs of the San Andreas Conduit over three days, approximately 30 million liters/day were conveyed to the College Hill Reservoir for distribution in the South Mission area of the city. By Day 5, approximately 55 million liters of water were flowing into the city, in addition to the 25 million liters still available in the reservoirs.

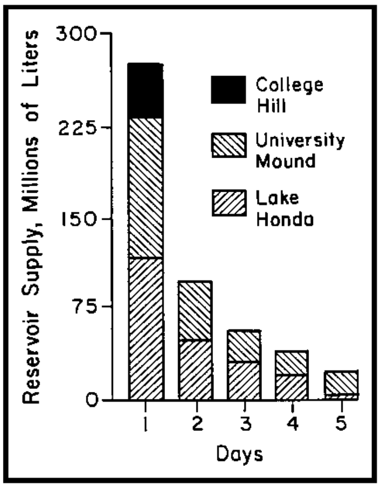


Figure 35 Reservoir Storage in San Francisco as a Function of Time After the Earthquake
Source: (O'Rourke, Beaujon and Scawthorn 1992)

2.3.4 Recent estimates of potential fire following earthquake losses

Since 1906 the insurance industry of course has had a profound interest in San Francisco and its potential for losses due to a future earthquake and fire – the impact on the industry had been huge (Whitney 1906) and interest continues to this day (LMA 2010). Freeman (Freeman 1932) was the first to seriously address estimation of fire following earthquake risk, and discusses San Francisco while not however providing estimates of potential loss. Steinbrugge (Steinbrugge 1968) highlighted the fire following earthquake problem in the San Francisco Bay Area and

[11] Following the earthquake, a person "started a fire in a stove to cook breakfast, about 9 o'clock. The chimney had been rendered defective by the earthquake, and fire broke out. This fire [may] have burned over more territory than any other single fire." (http://www.sfmuseum.org/1906/kennedy.html)

collected data (Steinbrugge et al. 1971) but San Francisco's fire following earthquake was only first quantified in 1987 (Scawthorn 1987).

Most recently, the City's Community Action Plan for Seismic Safety (CAPSS) examined potential losses, with findings as shown in Table 5 and Table 6. As can be seen, the CAPSS study examined four different earthquake scenarios, two of which are comparable to the scenarios examined in this study.

Table 5 Estimated Number of Fires and Size of Burned Area Following Four Scenario Earthquakes
Source: (ATC-52-1 2010)

Scenario	Average Number of Fires[a]	Size of Burned Area[b] (Million Square Feet)		
		Good Conditions[c]	Average[d]	Bad Conditions[e]
Hayward Fault, Magnitude 6.9	38	3.6	6.0	11
San Andreas Fault, Magnitude 6.5	57	4.7	7.3	14
San Andreas Fault, Magnitude 7.2	73	7.7	11	19
San Andreas Fault, Magnitude 7.9	95	11	17	28

a. This table shows the average estimated number of fires requiring professional response for the many analyses with varying circumstances. There would be additional small fires extinguished by residents or self-extinguished. Many more or fewer fires could occur.
b. These numbers represent the size of building floor space that is burned. Some of these buildings will also have suffered damage from earthquake shaking.
c. This estimate has a 75 percent chance of being exceeded. Under extremely favorable conditions, the burned area could be smaller.
d. This is the average estimate for the many analyses with varying circumstances.
e. This estimate has a 25 percent chance of being exceeded. Under extremely unfavorable conditions, the burned area could be larger.

Table 6 Average Cost of Damage Caused by Fire Following the Scenario Earthquakes
Source: (ATC-52-1 2010)

Scenario	Shaking Damage ($ Billions)[a]	Average Additional Damage Due to Fire[b] ($ Billions)	Shaking Plus Fire Damage[c] ($ Billions)
Hayward Fault, Magnitude 6.9	$14	$2.7	$17
San Andreas Fault, Magnitude 6.5	$20	$3.0	$23
San Andreas Fault, Magnitude 7.2	$30	$4.3	$34
San Andreas Fault, Magnitude 7.9	$48	$5.8	$54

a. These figures include direct damage to buildings from shaking and ground failure, in 2009 dollars.

b. These figures are averages for the many analyses with varying circumstances and do not double count shaking damage (i.e., burning rubble). Results are in 2009 dollars.

c. In 2009 dollars. Numbers in table have been rounded, which can make totals differ from sum of columns or rows.

2.4 San Francisco's Emergency Firefighting Water System

2.4.1 EFWS high-pressure network

Following the experience in 1906, Marsden Manson (San Francisco City Engineer) in 1908 proposed the high-pressure network that Chief Sullivan had advocated during the prior decade. Its construction was funded with a $5.2 million bond issue and largely completed by 1912, see Figure 36.

This original AWWS is now part of the City's large EFWS (Emergency Firefighting Water System), which is still being expanded.

In summary, the EFWS high-pressure network consists of several major components, see Figure 37.

- Static Supplies: The main source of water under ordinary conditions is a 10-million-gallon (40 million liter) reservoir centrally located on Twin Peaks, the highest point within San Francisco (approximately 227m or 750 ft. elevation).

- Pump Stations: Because the Twin peaks supply may not be adequate under emergency conditions, two pump stations exist to supply salt water from San Francisco Bay - each has 10,000 gpm (667 l/s) at 300 psi (20.7 bar) capacity. Both pumps were originally steam powered but were converted to diesel power in the 1970's.

- Pipe Network: The EFWS high-pressure network supplies water to dedicated street hydrants by a special pipe network that, by the end of the 1980s, had a total length of approximately 120 miles (200 km). The pipe is bell and spigot, originally extra heavy cast iron (e.g., 1”- or 25-mm wall thickness for 12" or 300 mm diameter), and more recent extensions are heavy ductile iron (e.g., .625" or 15mm wall thickness for 12" or 300 mm diameter). Restraining rods connect pipe lengths across joints at all turns, tee joints, hills and other points of likely stress.

Figure 36 Manson map of 1908 showing plan for an auxiliary water system for fire protection (Manson et al. 1908)

- Fireboats: A major deficiency in 1906 was the lack of a Fireboat to be able to pump large volumes from San Francisco Bay. Chief Sullivan in 1905 had proposed that the City purchase a Fireboat, but the request was denied. With the construction of the high-pressure network in 1912, two powerful steam fireboats were provided, each capable of pumping 10,000 gpm (40,000 l/s) into the high-pressure network in addition to the two pump stations. The pipe network has manifold connections located at several points along the City’s waterfront in order to permit the City’s two fireboats to act as additional “pump stations”, drafting from San Francisco Bay and supplying the high-pressure network.

- Cisterns: SFFD in 1906 was finally able to establish a water supply along Van Ness Avenue, a natural east-west fire break as it is 150 feet wide. Water supply was from US Navy ships and tugboats at the foot of Van Ness Ave. The successful experience of cisterns in 1906 led to the construction between 1912-1940 of 128 75,000-gallon capacity cisterns (200,000 liters, about one hour supply for a typical fire department pumper), every three blocks from SF Bay to Market Street and at other locations. Van Ness Ave remains today as the major fire break in the Northeast section of the city. Today, San Francisco has 172 underground cisterns, largely in the northeast quadrant of the city but with newer cisterns in outer residential areas.

The significance of this fire break is important, since the building stock west of Van Ness, to and including Pacific Heights is mainly wood frame, and virtually intact as it was in 1906 – large wood frame buildings of 3 to 4 stories in height, a conflagration hazard. The area east of Van Ness Ave, to Stockton Street, including Telegraph hill was completely burned off in 1906. In the rush to rebuild, it was reconstructed virtually as it was, recreating the conflagration hazard that previously existed. With occasional high winds, narrow streets and densely built wood frame building of 3 to 4 stories in height, this section of San Francisco today is as significant a conflagration hazard as it was in 1906.

Figure 37 San Francisco EFWS high-pressure network

The EFWS high-pressure network is a remarkably well-designed system for reliably furnishing large amounts of water for firefighting purposes under normal conditions, with many special features to increase reliability in the event of an earthquake. A key aspect of San Francisco's ability to maintain and even extend this unique system is that fact that it is, by city charter, owned and operated by the fire department. The EFWS high-pressure network is intended as an *auxiliary* system, to supplement the use of the municipal water supply system for fighting large fires, under non-earthquake as well as earthquake conditions. This is an important point – it does not sit around for decades, waiting for an earthquake. Rather, the department uses it at most greater alarm incidents, thereby gaining valuable experience, confirming its continued functionality and reliability, and justifying the system's existence. Another point is that the underground piping system was designed from the beginning to be highly earthquake resistant – the piping is extra heavy walled and has restrained joints to resist pullout at numerous locations.

While the original portions of the high-pressure network were built during 1908-1912, the City has continued to invest and expand the system, as shown in the following tables and figures.

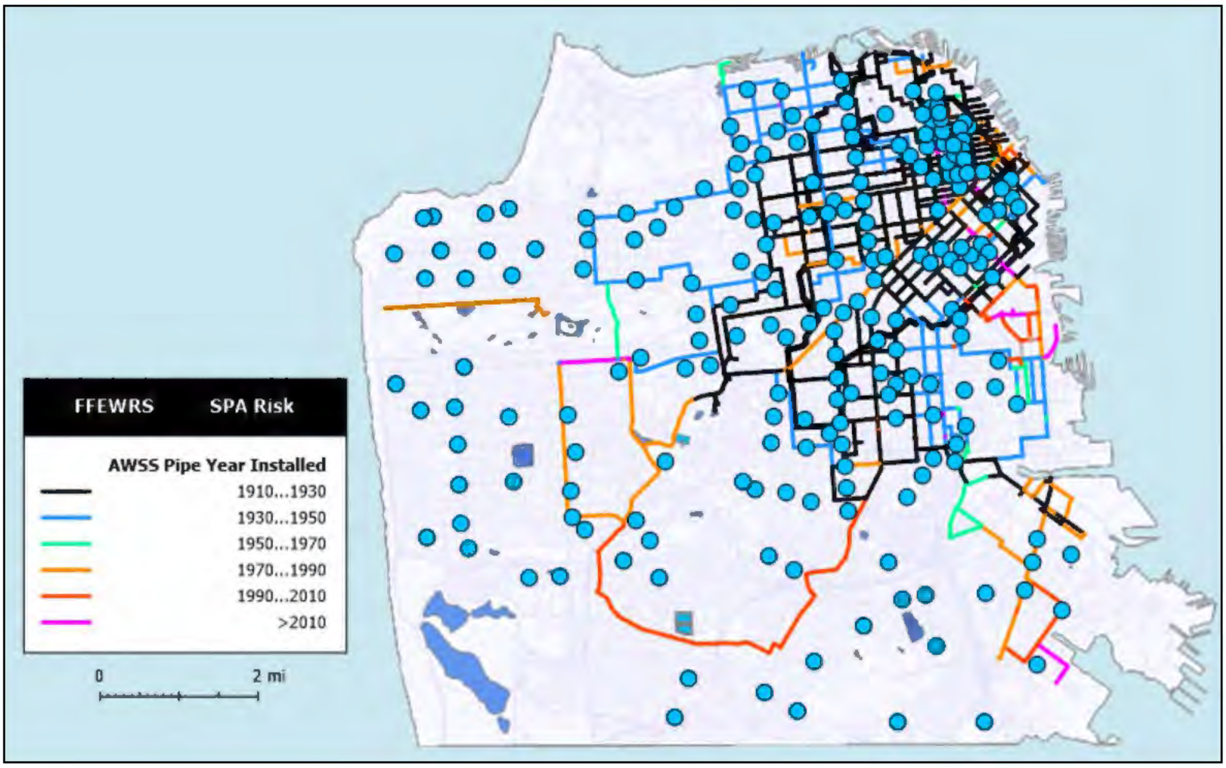


Figure 38 EFWS high-pressure network construction by era, Circles are cisterns.

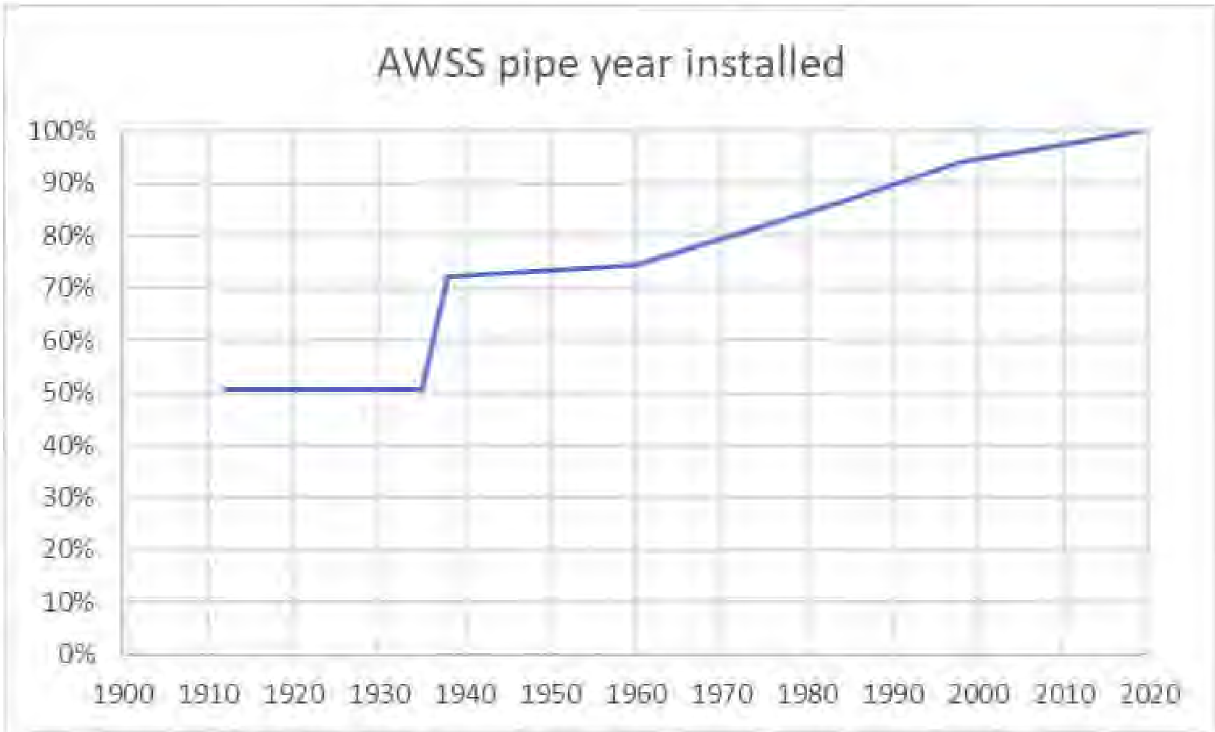


Figure 39 Fraction of EFWS high-pressure network pipe by year of installation

Table 7 San Francisco's capital investments in the EFWS

Yr	Yr $ mills	2020 $ mills	Pop. (th)	cum 2021 $ / cum(p-yrs)	Notes
1908	$5.2	$156.4	402		original cost
1933	$2.0	$40.4	634	$12.07	+ Marina, W Addition, Mission
1970	$1.0	$6.9	716	$5.68	estimated portion of larger bond issue
1974	$0.2	$1.1	701	$5.60	adds 3rs St. Crossing; est. of larger bond
1977	$1.0	$4.5	690	$5.44	no specifics; est. of larger bond
1986	$46.2	$109.8	706	$4.84	+ cisterns + Ocean Ave ext + MOVs
2010	$102.4	$123.1	805	$5.18	+ cisterns + renovations
2014	$55.0	$61.2	836	$6.74	investments to be determined
2020	$153.5	$155.0	882	$7.00	investments to be determined
2021	$0.0	$0.0	882	$9.08	includes 2020 bond $
No. Yrs.	Tot Yr $	Tot 2020 $			
113	$367	$658			

Note 1: 2021$ are current value of Yr $ ref: https://www.multpl.com/cpi/table/by-year

Note 2: San Francisco population data from https://en.wikipedia.org/wiki/Demographics_of_San_Francisco

Note 3: does not include operating and maintance costs

Note 4: No information could be found re 1960's bond issue, so data and amount are estimated

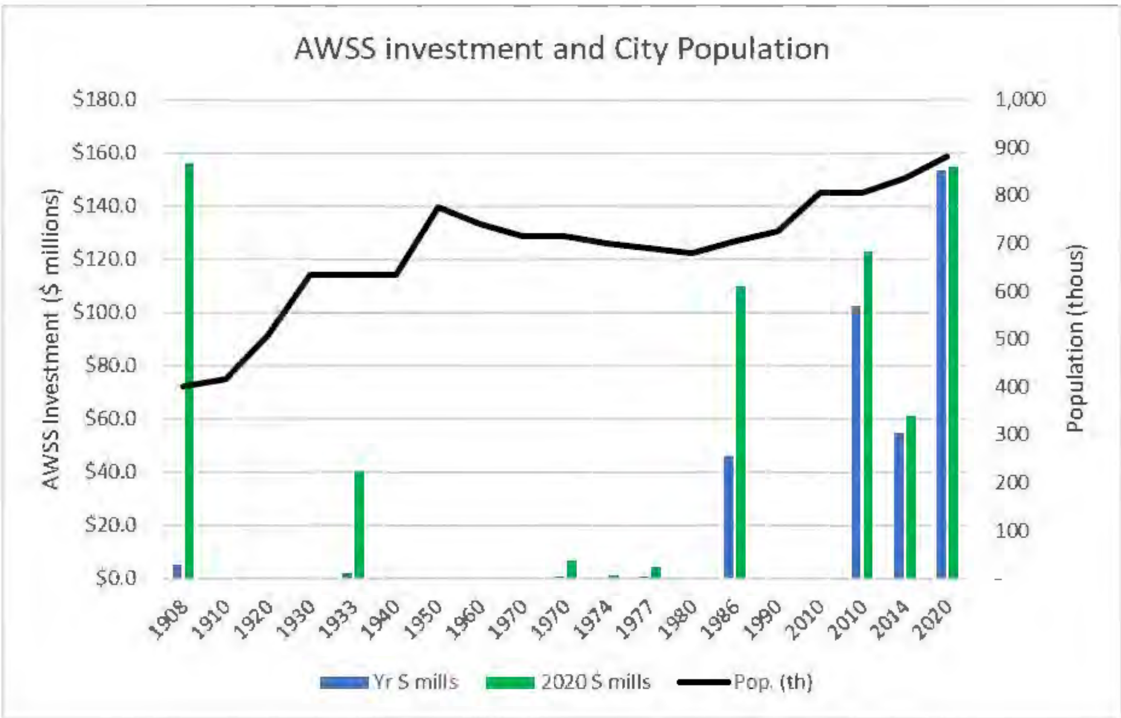


Figure 40 EFWS high-pressure network investment in both $ for that year (blue column) and 2020$ (green column), and City's population (black line)

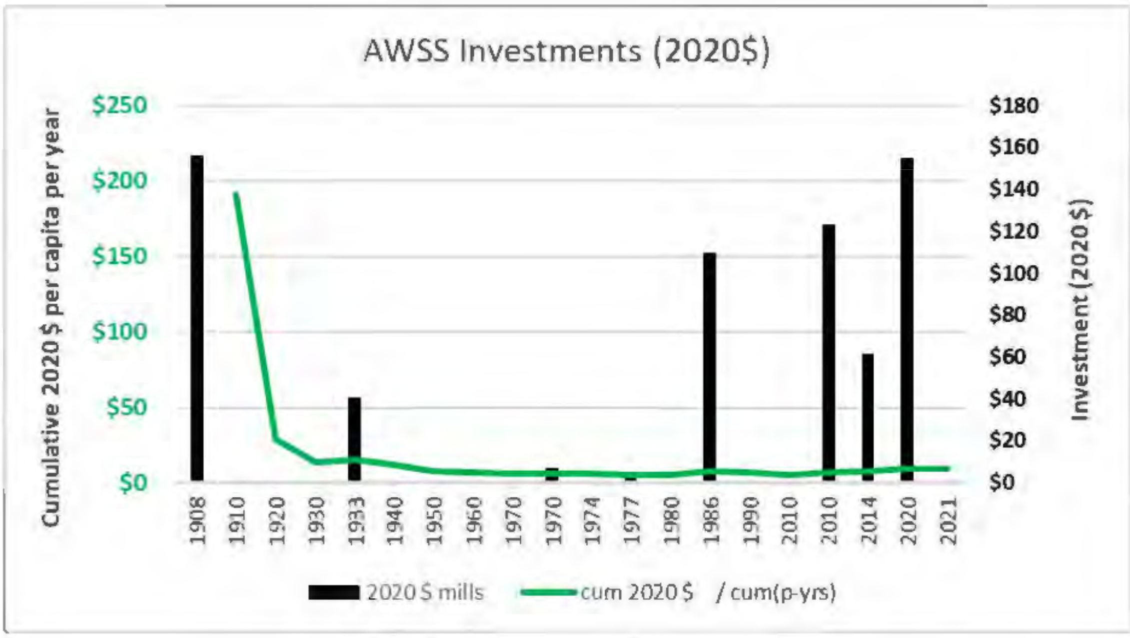


Figure 41 EFWS high-pressure network investment in 2020$ (black column) and cost per capita per year (green line). By 1933 the initial 1908 $5.2 million high-pressure network construction ($156 million in today's dollars) averaged $12 per capita per annum. The trend of averaged succeeding investments declined to less than $6 pc pa, while investments since 2010 have reversed this trend with total investments today averaging about $8 pc pa.

2.4.2 "Infirm Areas"

San Francisco has areas of highly liquefiable soils – these were observed to fail in 1906 and to correlate with damage to underground piping. These locations were mapped with other areas of concentrated damage as 'infirm zones', Figure 43, and the system designed so that, while EFWS high-pressure network pipe passes through these zones, Figure 42, the system can be quickly isolated should pipelines in those zones fail.

In modern times, the gate valves isolating the infirm zones have been motorized and can be remotely controlled via radio. As a result of the elevation of the Twin Peaks reservoir, and the capacity of the pumping stations and the fireboats, very high-pressures, in excess of 300 psi, can be sustained in the EFWS high-pressure network. This pressure assures a high-volume supply, but is too high for many applications, and can be reduced via Gleeson valves – a patented pressure reduction valve invented in the San Francisco Fire department shops. The Gleeson valve permits a firefighter to attach one or several handlines to 1 high-pressure network hydrant, and apply fire streams as if from a fire engine. Thus, the EFWS high-pressure network reduces the need for fire engines and permits a continuous water curtain to be sprayed from a line of hydrants along a defensive line.

Designed almost a century ago with great foresight and skill, the San Francisco EFWS high-pressure network was intended to be a seismically reliable water supply system for fire protection. Most of the original pipeline was extra heavy cast iron pipe with more recent installations using thick-walled ductile iron pipe with restrained joints at high thrust locations. It has been maintained for almost a century and embodies the key attributes of redundancy in supply and layout, reliability via layout and seismic design of components, flexibility in application, economy via reducing the need for fire engines and apparatus, and integration in the fire department's day-to-day operations. Even so, the 1989 Loma Prieta earthquake damaged a few components of the EFWS high-pressure network, which, coupled with human inaction, drained the Lower Zone (Scawthorn 1990a)and prevented the system from supplying water to the Marina fires; thus, demonstrating that there is room for improvement.

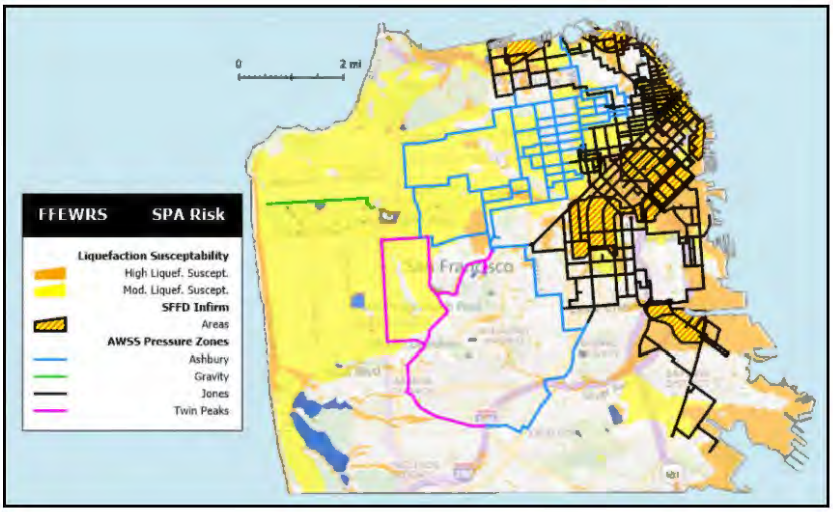


Figure 42 Current EFWS high-pressure network showing pressure zones overlaid on liquefaction susceptibility and SFFD Infirm Areas (red and yellow hatched areas). Twin Peaks Zone (magenta) is primarily to west of Twin Peaks; Ashbury or Upper Zone (blue) is intermediate between Twin Peaks and Jones or Lower Zones (black). A Gravity system (green) is an independent pipeline fed from Stowe Lake and runs west along Fulton St.

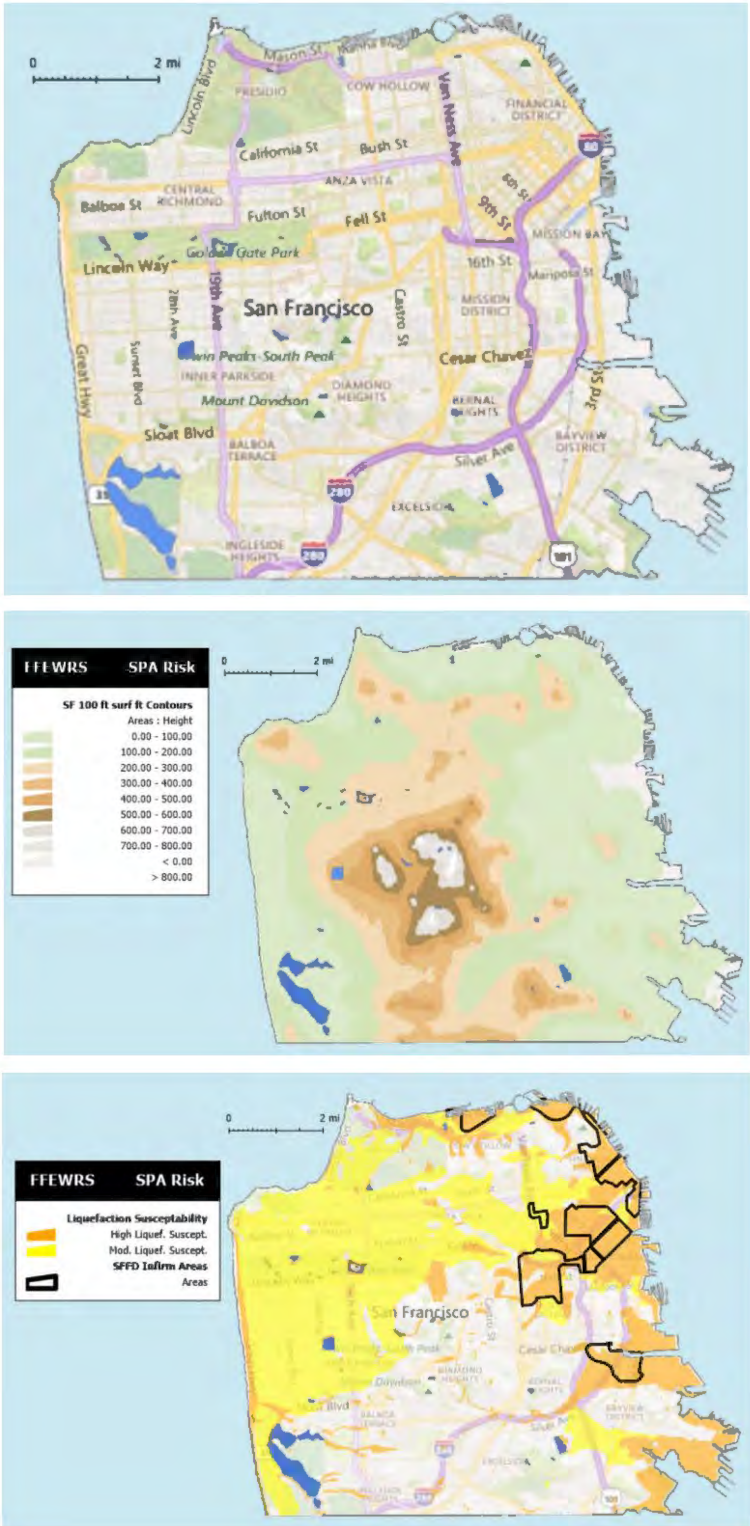


Figure 43 (top) City; (mid) Elevations; (bott) Liquefaction susceptibility and SFFD Infirm Areas

3 DATA

A large amount of data was collected and employed in this project. Data included exposure including detailed information on buildings and tree canopy, data on earthquake ground motions and permanent ground displacement, fire resources, water supply, streets and access, and weather.

3.1 INTRODUCTION

This section discusses the data used for analysis.

3.2 Exposure

3.2.1 Current buildings at risk

Data on San Francisco's buildings, both present and projected in the future, was collected from a number of sources, primarily the Planning Department and its GIS portal. Commensurate with current population, the current total floor area of all high-rise buildings in the City is estimated to be approximately 215 million square feet, and all low- and medium-rise buildings 670 million square feet, with an aggregate structure and contents replacement value of about $530 billion (2020 $)[12]. Figures below show selected data on land use, gross square footage and building height, building footprints and materials of construction.

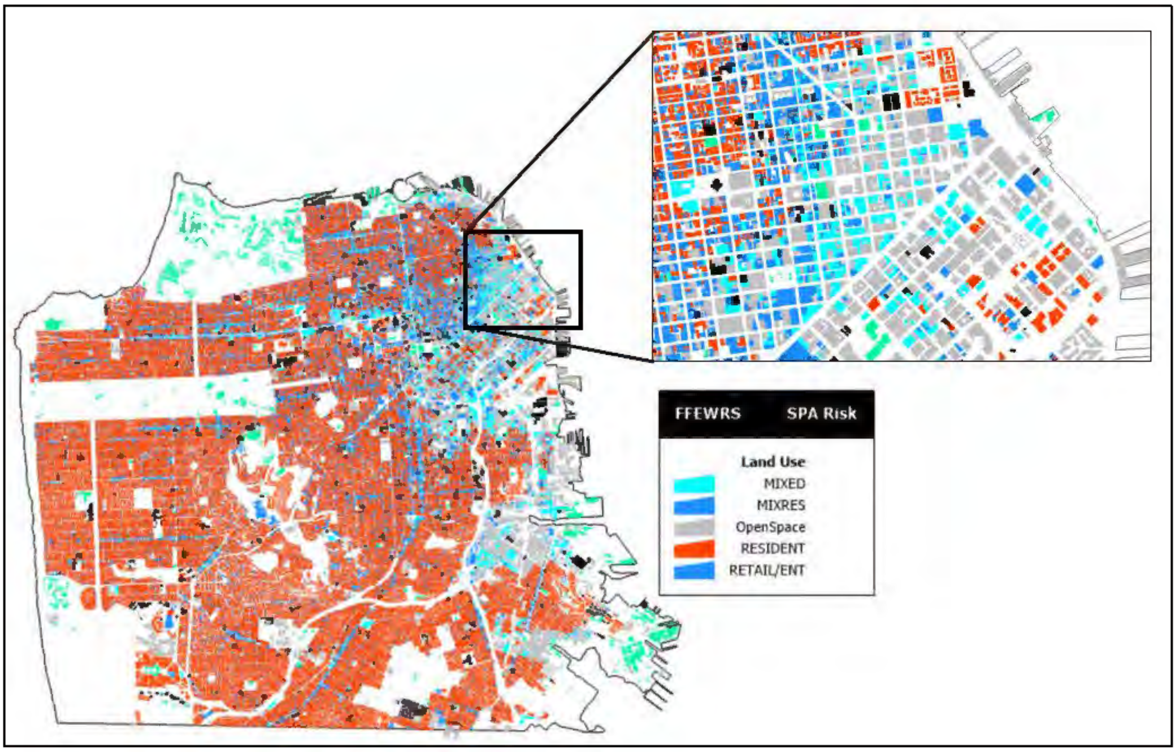


Figure 44 Land Use

[12] $600 per square foot, in 2021$, is used as average replacement value for buildings and their contents.

Figure 45 (left) Total Floor Area (TFA, sq. ft.) per block, for Low and Medium Rise buildings; (right) TFA per block for High Rise buildings.

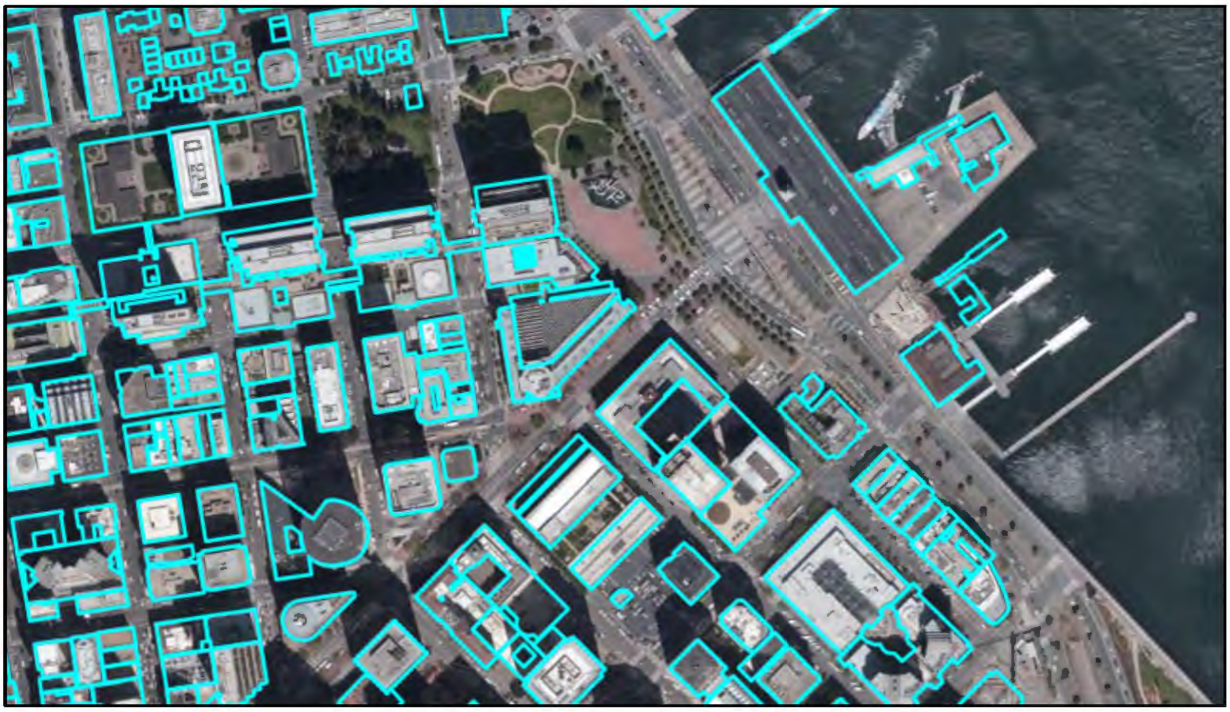


Figure 46 Building footprints

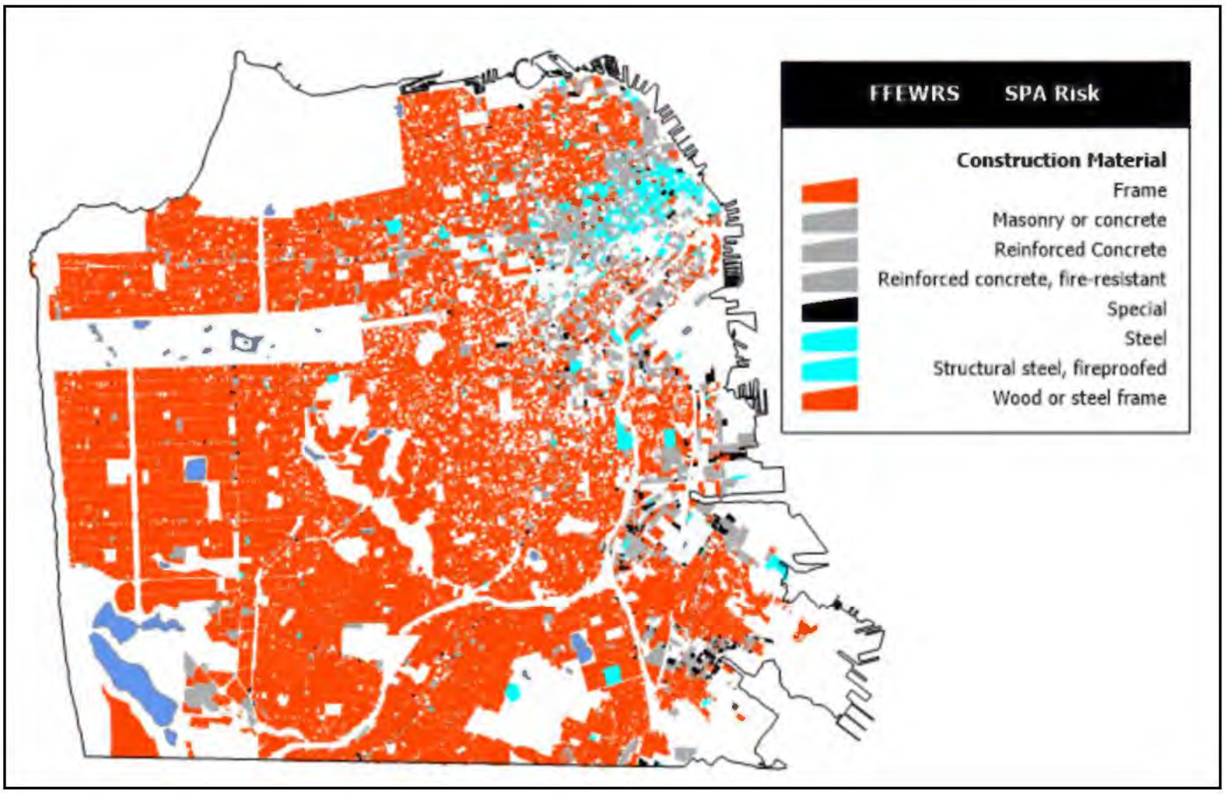


Figure 47 Materials of construction

Exposure data was also obtained for the Presidio, with processing of this and data for other large non-homogeneous occupied tracts of land currently listed as one "city block" in the City's databases. These large tracts of land are highlighted in red in Figure 55, which shows all city blocks (outlined in gray) and every building in the City (outlined in blue), with a detail for the Presidio.

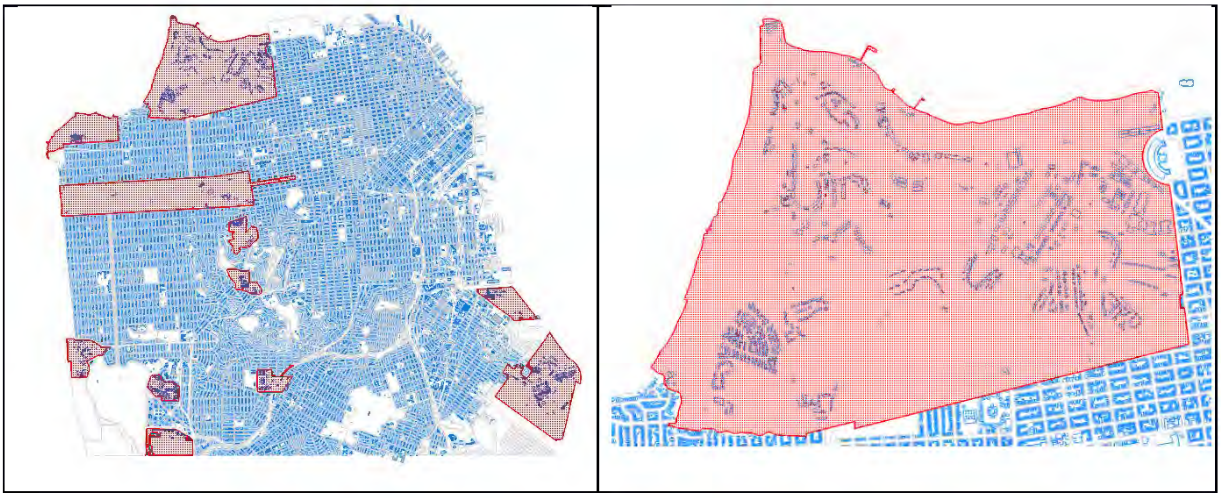


Figure 48 (left) large tracts of land highlighted in red with all city blocks outlined in gray and every building in the City outlined in blue; (right) detail for the Presidio.

Fire following earthquake analysis analyzes fire spread in several stages – within a building, within a city block, and then at firebreaks (e.g., city streets). City blocks are typically densely and homogeneously occupied by buildings of a similar nature, which however is not the case in the Presidio or these other large tracts.

To account for this, the current Presidio and other large tracts have been divided into "new blocks", each of a similar nature, as shown in Figure 49 for the Presidio. In summary, the one Presidio "block" has been subdivided into 47 "new blocks", and a total of 79 "new blocks" were created from the large tracts shown in Figure 48.

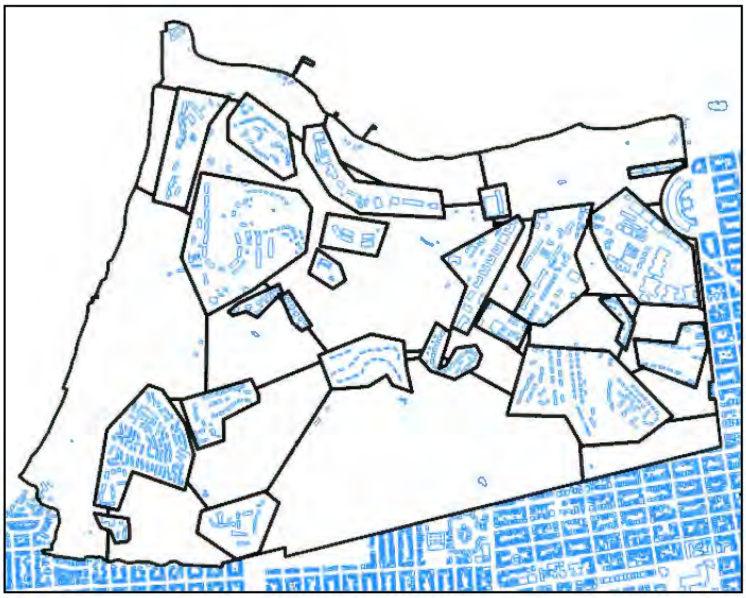


Figure 49 "new blocks" created in Presidio

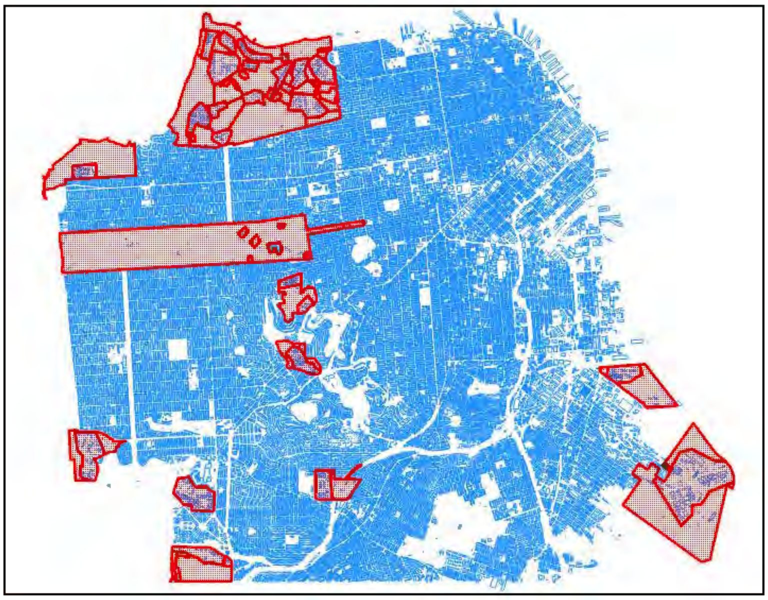


Figure 50 "new blocks" created from large tracts

3.2.2 Future building exposure

As discussed in section 2.1, San Francisco is expected to continue to grow, with today's population of 880,000 growing by 2040 to 1.1 million. Based on population and traffic projections, the total floor area of all buildings in the City is estimated to grow to 1.1 billion sq. ft. by 2040 and 1.25 billion sq. ft. by 2050, with an aggregate structure and contents replacement value of $665 billion in 2040, in 2021 dollars. Much of this growth will occur in eastern portions of the City, as shown in Figure 51 to Figure 53.

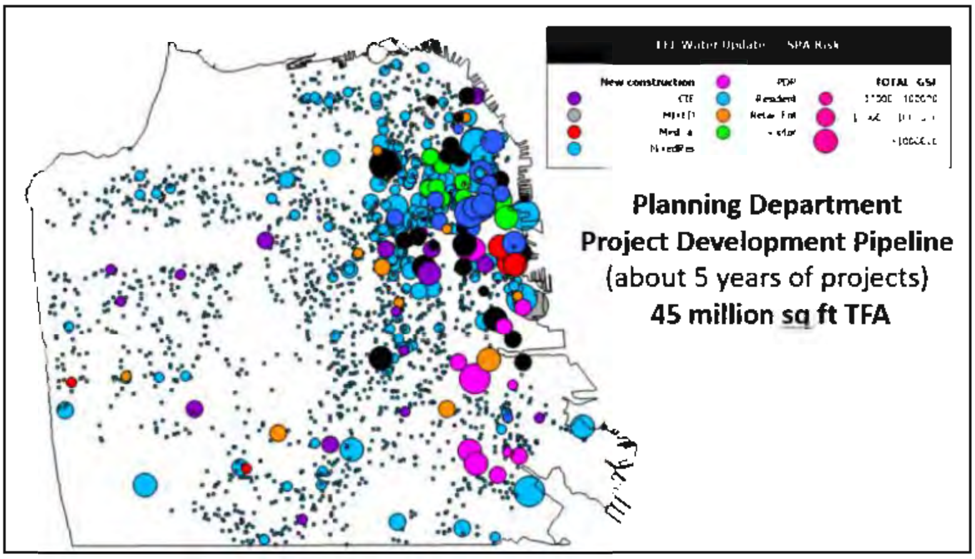


Figure 51 San Francisco "in pipeline" building projects, totaling about 45 million sq ft. of new construction. (Source: San Francisco Planning Department)

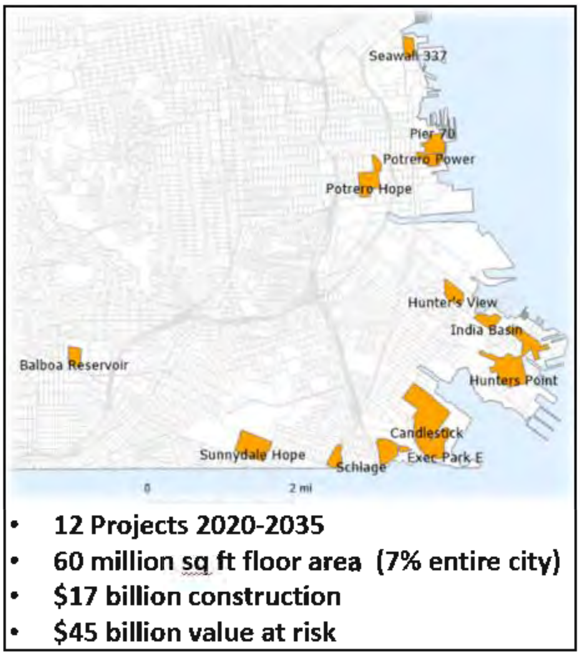


Figure 52 Known specific larger developments in various stages of planning or construction, totaling about 60 million sq. ft. of new construction. (Source: AECOM)

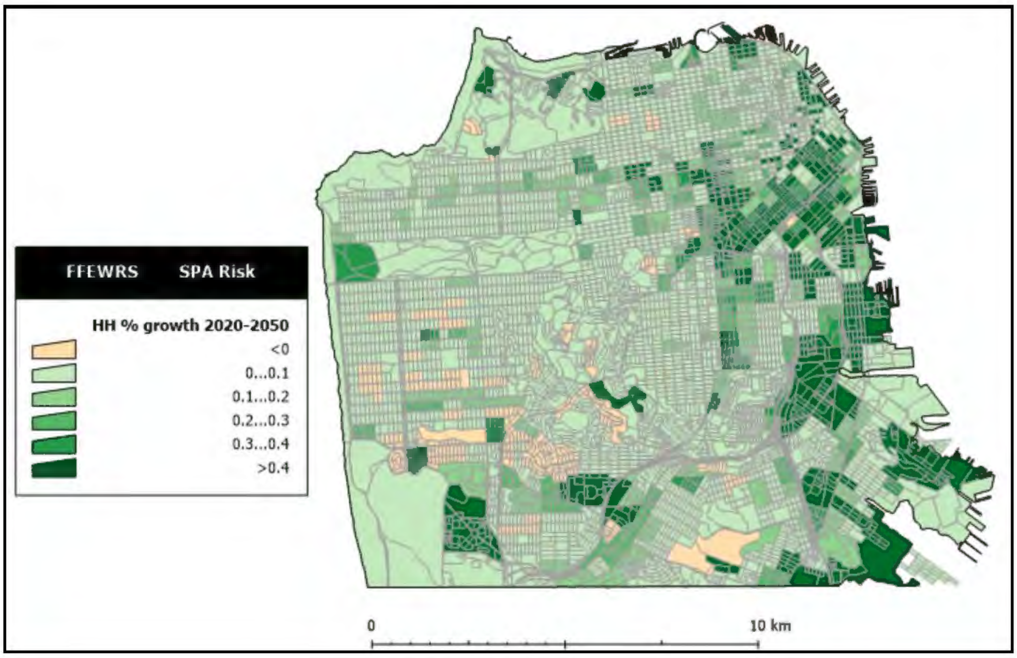


Figure 53 Percentage growth in Households (HHs) 2020-2050

3.2.3 Tree canopy

Vegetation, particularly larger trees, can play a significant role in firespread, especially in hot dry weather conditions. Two databases for trees exist for San Francisco – those are trees in public lands (including those lining streets), and those in private lands (e.g., backyards). These were merged into a single database of 290,000 records, and a detail of that database is shown in Figure 54. Inclusion of the tree canopy in the overall analysis is important in order to account for San Francisco's large green spaces, such as the Presidio, Golden Gate, McLaren, Lincoln, Sigmund Stern Grove and Glen Canyon parks and Mt. Davidson.

Figure 54 Detail of tree canopy data employed for this study.

3.3 SCENARIO EARTHQUAKES AND GROUND MOTIONS

3.3.1 Scenario events

This study has assessed two scenario earthquakes: (1) a Mw 7.9 event on the San Andreas fault like the 1906 event, and (2) a Mw 7.05[13] event on the Hayward fault in the East Bay. Comparable events were among those also examined in the CAPSS study (ATC-52-1 2010). Ground motions from either of these events will be very strong in San Francisco, with the Mw 7.9 San Andreas event being generally stronger, especially in the western portions of the City, which are only a few miles from that fault. The Hayward event, while generally having similar or smaller ground motions than the San Andreas event, is considered more likely to occur in the near future (Detweiler and Wein 2017).

3.3.2 Ground motions

Estimates of ground motion are needed as an input for the estimation of post-earthquake ignitions (Lee et al. 2008; Scawthorn 2018b; TCLEE 2005). This study applies four of the NGA-West2 ground motion prediction equations (GMPEs) to predict ground motion in the shallow crustal earthquake scenarios (EQ3 and EQ4), the specific GMPEs being (Abrahamson, Silva and Kamai 2014; Boore et al. 2014; Campbell and Bozorgnia 2014; Chiou and Youngs 2014). Each of the GMPEs is assigned equal weight for predicting both the peak ground acceleration (PGA) and peak ground velocity (PGV).

Soil stiffness is an important influence on the intensity of ground motions, and a common measure is the shear wave velocity of the upper 30 meters of the soil column, denoted Vs30. Vs30 data for San Francisco was acquired from (Wills et al. 2015) and is shown in Figure 55. This data was georeferenced to each city block, as shown in the same figure.

For both scenarios, the Jayaram and Baker (Jayaram and Baker 2009) model for spatial correlation of ground motion was applied. This model gives the correlation coefficient (ρ) for the within-event residuals of ground motion at two locations as a function of their separation distance. Jayaram and Baker (2009) did not study PGV directly. However, it is generally accepted that the spatial correlation of PGV is similar to that of spectral acceleration at a period of 1 second, and we apply this rule of thumb to obtain correlation coefficients for PGV. This use of spatially correlated ground motions for infrastructure performance and loss estimation is still rather innovative, and a novel contribution of this study.

To generate a spatially correlated field of ground motion for a given scenario, we took the sum of (i) the logarithmic median predicted by the GMPE(s) on a per-location, per-realization basis, (ii) a random sample of the between event residual, which is normally distributed with zero mean and variance τ^2 given by the GMPE(s), on a per-realization basis, and (iii) spatially correlated samples of the within event residual, which is normally distributed with zero mean and variance φ^2 given by the GMPE(s), on a per-location, per-realization basis. We generate 100 realizations of each scenario for both PGA and PGV.

[13] The two digit precision for the Hayward event is due to the USGS Haywired project (Detweiler, S.T., and A.M. Wein (Eds.). 2017. *The HayWired earthquake scenario—Earthquake hazards (ver. 1.1, March 2018):*. Washington: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, available at https://pubs.er.usgs.gov/publication/sir20175013v1.. Such precision for earthquake magnitude is somewhat illusory, and hereafter the Hayward event magnitude will be denoted at Mw 7.

The Jayaram and Baker (2009) model for the spatial correlation of ground motion depends on whether site conditions in the region of interest are clustered or not. We assume that the site conditions in San Francisco are clustered based on Figure 56, which shows a semivariogram of the $V_{S,30}$ data used in this study, which shows a clear relationship. See Jayaram and Baker (2009) for examples of the clustered and unclustered cases.

Median PGA for the two scenarios are shown in Figure 57 to Figure 58. As discussed above, there is considerable variation in actual ground motion – for example Figure 59 shows three of the one hundred realizations of spatially correlated ground motion, for the two scenarios. It can be seen from these figures that the Mw 7.9 San Andreas scenario is by far the more severe event, and that only in the eastern-most portion of the City are the two events comparable.

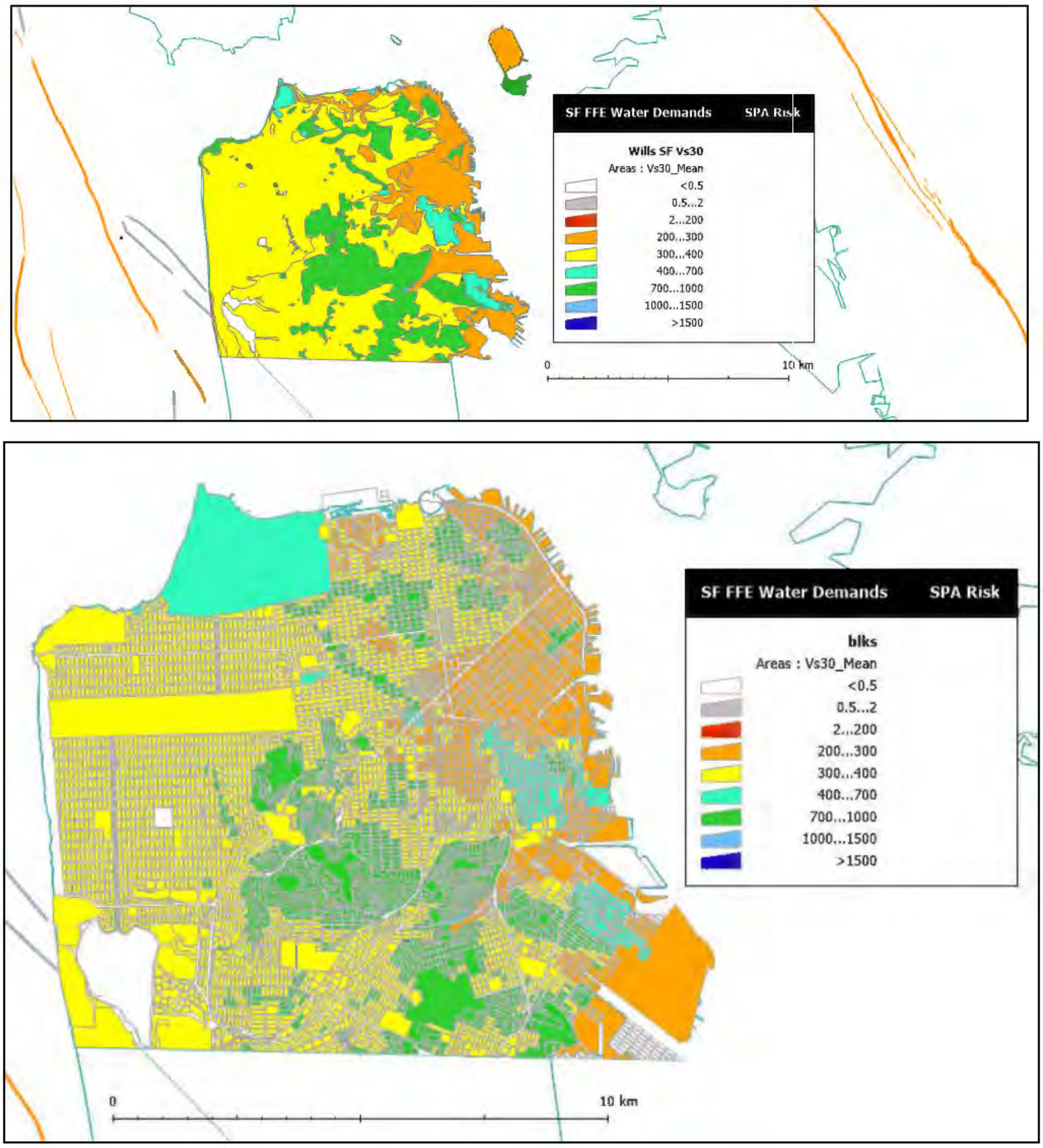


Figure 55 Wills Vs30 data

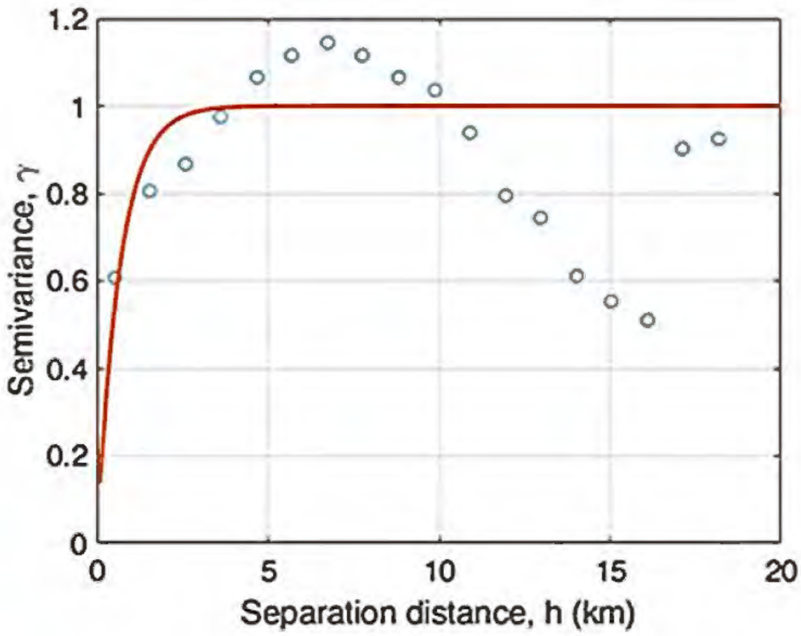


Figure 56 Empirical semivariogram of the site conditions (Vs30) in San Francisco .

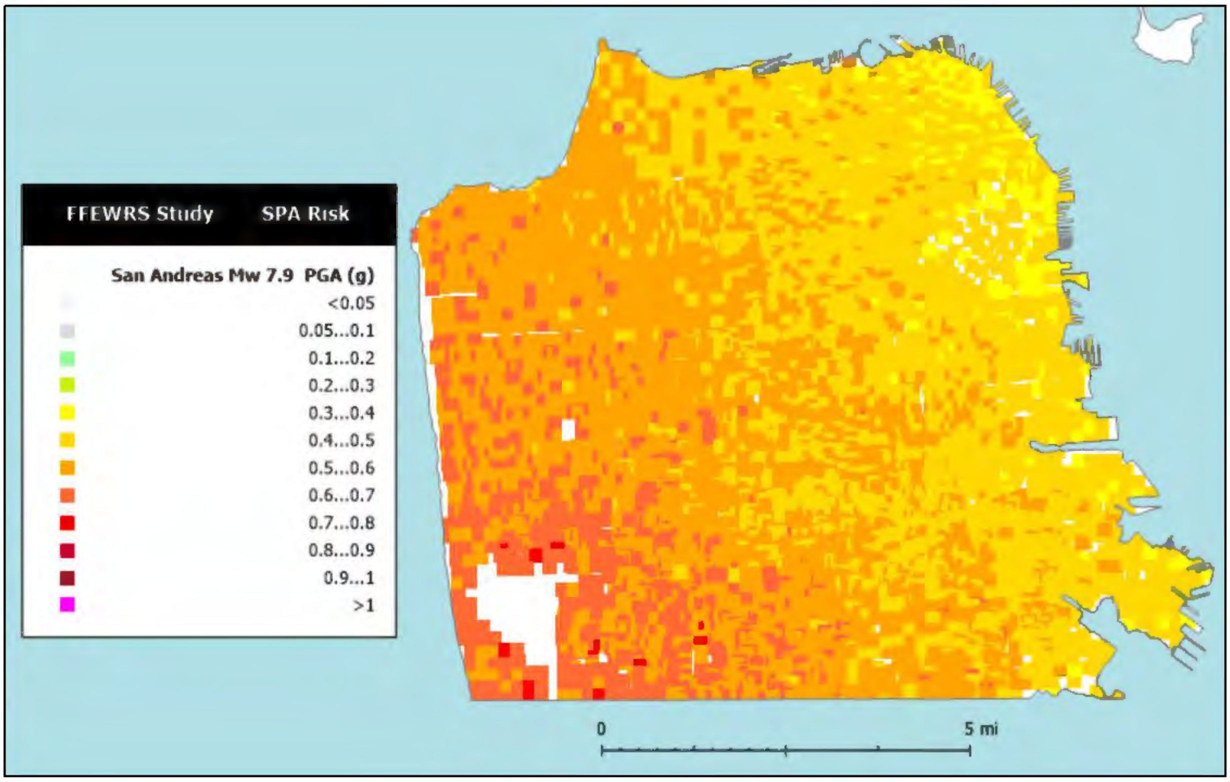


Figure 57 Median Peak Ground Acceleration (g), Mw 7.9 San Andreas event

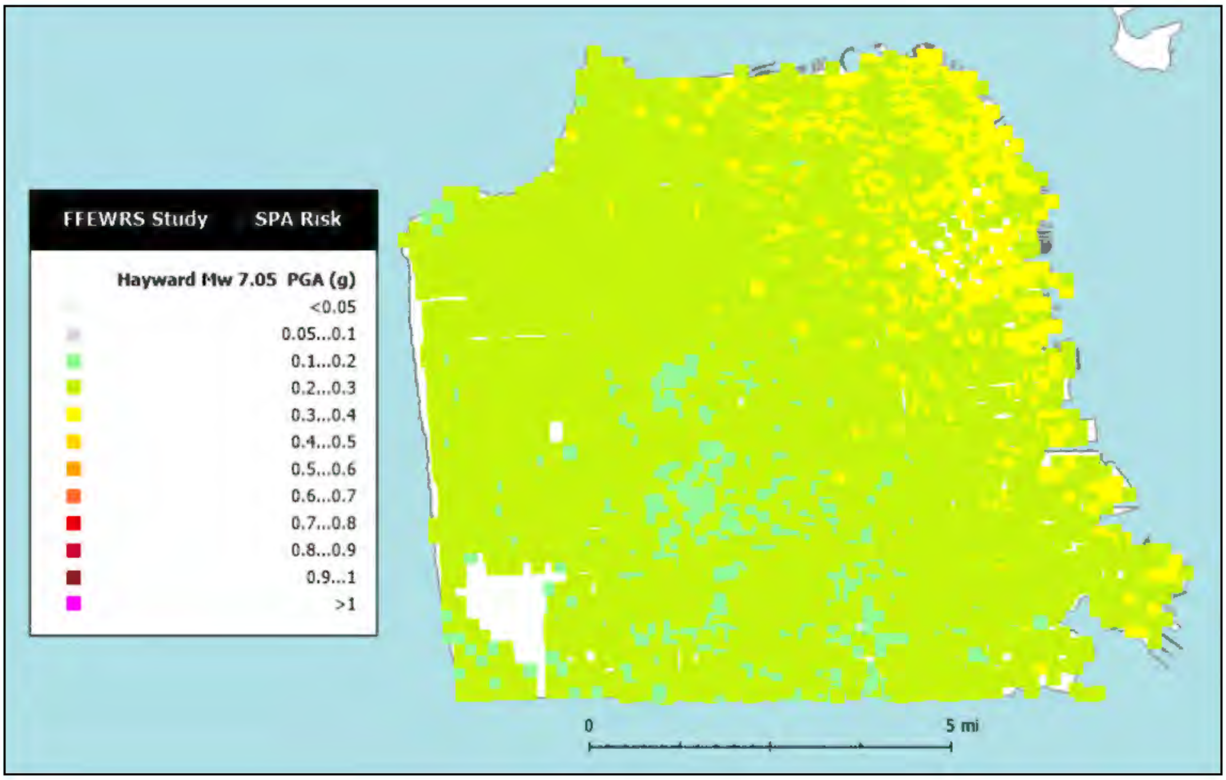
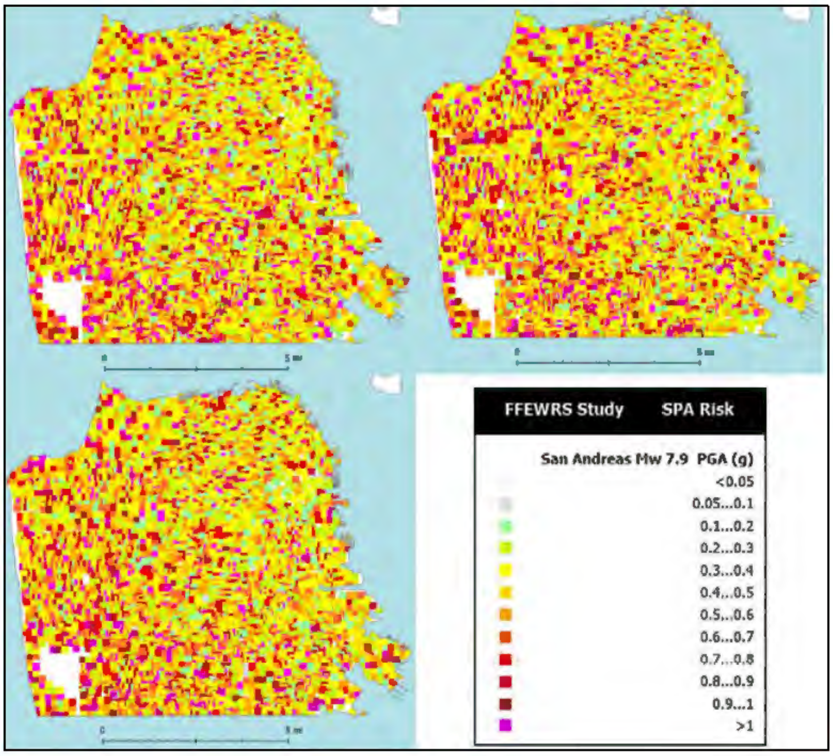


Figure 58 Median Peak Ground Acceleration (g), Mw 7 Hayward event



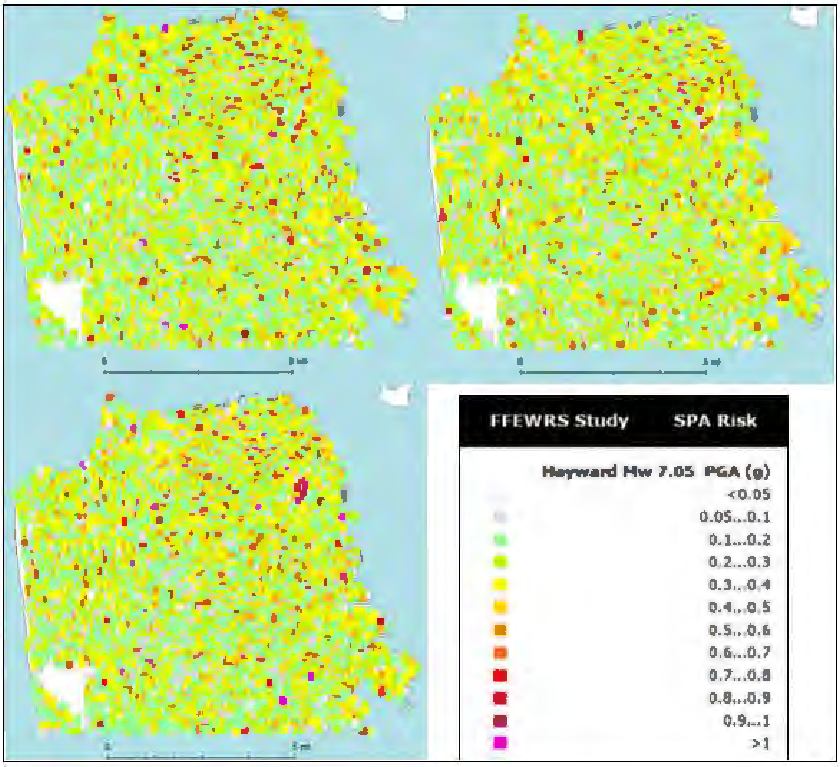


Figure 59 Three of one hundred realizations considering spatial correlation for mean Peak Ground Acceleration (g): (top) Mw 7.9 San Andreas; (bott) Mw 7 Hayward events

3.3.3 Permanent Ground Displacement

Permanent ground displacement (PGD) is relevant to fire following earthquake due to the damage and loss of service it will cause to buried water and gas pipelines, thus reducing availability of firefighting water while simultaneously increasing the presence of flammable gas and potential for fire and explosion. Permanent ground displacements can occur due to a number of mechanisms: abrupt relative displacement such as at the surface expression of a fault or at the margins of a landslide, or in spatially distributed PGD which can result for example from liquefaction-induced lateral spreads or ground settlement due to soil consolidation. In this study, we consider soil liquefaction and landslide due to earthquake, as they are anticipated to be a major influence on buried water, particularly South of Market.

Liquefaction is generally associated with saturated cohesionless uniformly graded soils that contain few fines, and results from seismic shaking that is of a sufficient intensity and duration to cause soils to undergo volume reduction upon shaking. Under these conditions, cohesionless soils will tend to densify when subjected to cyclic shear stresses from ground vibrations but will be temporarily prevented from doing so at depth due to restricted drainage. As a result, excess pore pressures accumulate, effective stresses decrease, and soils lose strength and may become liquefied (Seed and Idriss 1982). Because the capacity of soils to withstand loads (including their own self-weight) is directly related to their strength, liquefied soils may undergo permanent displacements both vertically and horizontally, so that liquefaction poses a serious hazard to constructed structures whether above ground or buried. The first step in quantifying the potential for liquefaction and PGD is mapping surficial soils and their relative vulnerability.

Estimation of the probability of liquefaction follows established procedures (DHS 2003) and is based on published mapping of liquefaction susceptibility data, Figure 60 (Knudsen et al. 2000).

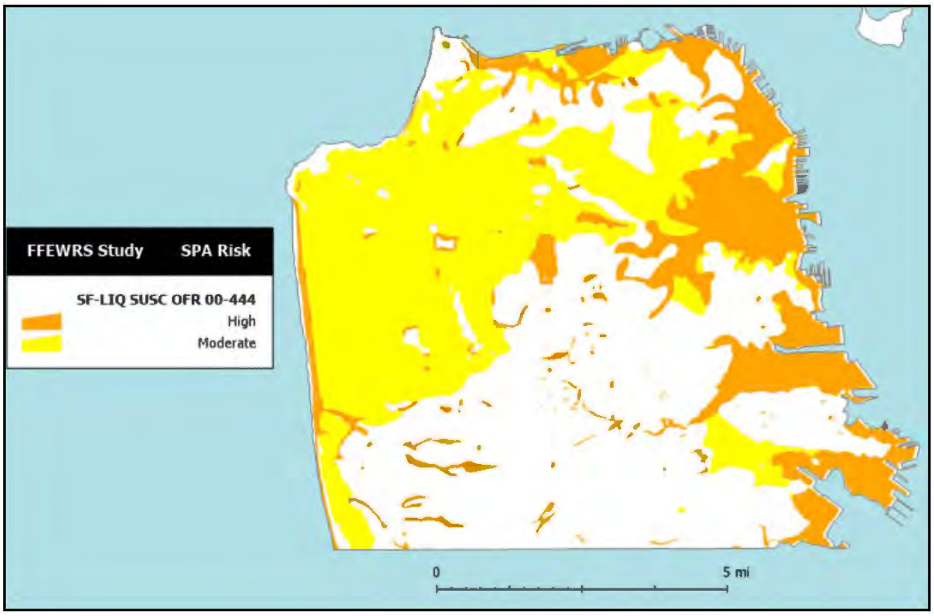


Figure 60 liquefaction susceptibility
Source: (Knudsen et al. 2000)

3.4 Fire resources – SFFD and mutual aid

3.4.1 SFFD resources

The San Francisco Fire Department provides primary fire protection for the City and is considered as the first and only responder for the initial fires following the scenario events. SFFD also provides protection to the Presidio, Treasure Island (both within CCSF) and San Francisco International Airport, where it maintains three stations. Data was collected on SFFD's resources

Figure 61 and Table 8 show locations of SFFD's 44 fire stations within the City, and associated fire engines[14]. These stations were reviewed for seismic adequacy in the mid-1980s (Eqe/ags 1989) and subsequently most of the stations were rebuilt or seismically retrofitted, so that today the great majority of stations may be considered as seismically reliable in the four scenario events considered here.

[14] Stations also house other apparatus, such as ladder trucks, but fire engines apply the water and are the critical apparatus for this analysis. A complete inventory of SFFD apparatus is available at www.ufsws.org .

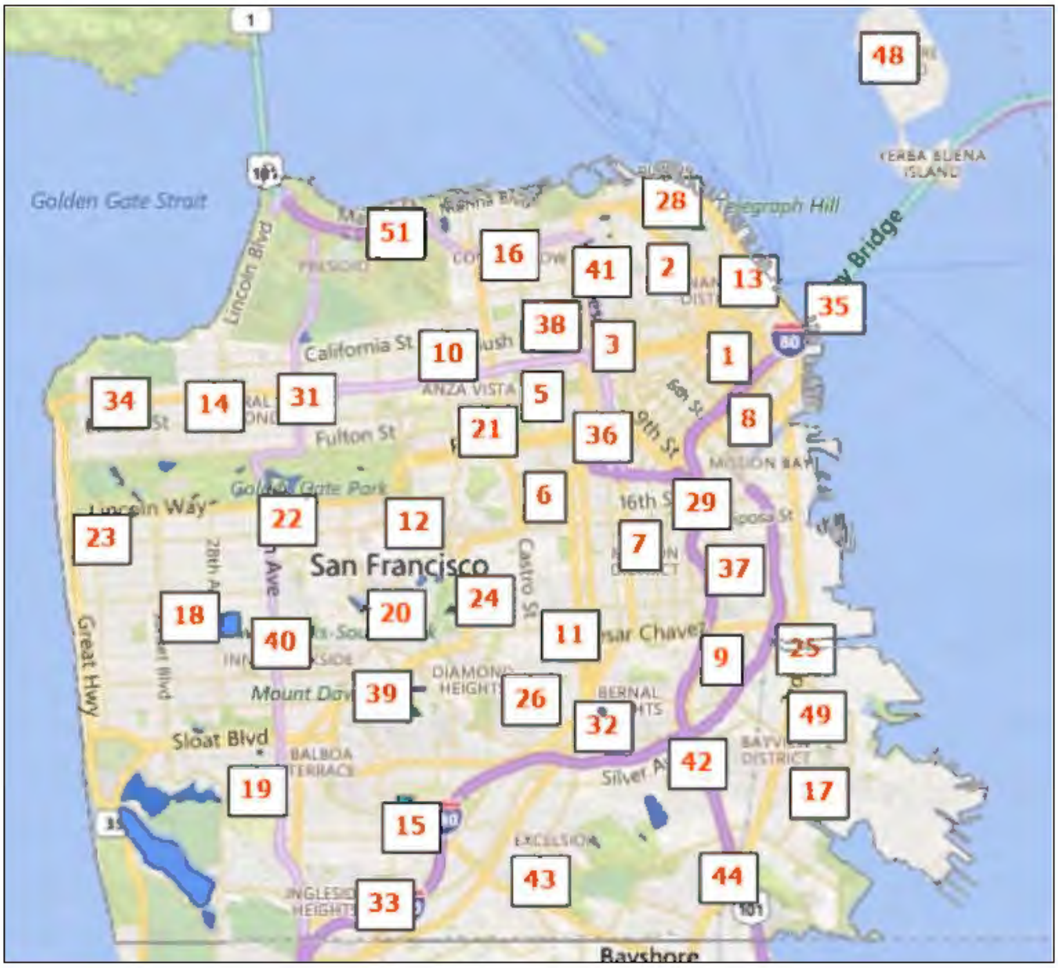


Figure 61 SFFD fire station numbers and locations

Under normal operations, SFFD operates one engine from each station, as well as one truck and/or other apparatus and equipment from selected stations[15], for a total of 44 engines and 20 ladder trucks. SFFD also has on average five ready reserve engines that would be put in service in an earthquake emergency[16], and typically five other spare engines that would be put in service with some delay since they are not normally stocked with hose and equipment. SFFD also operates two dedicated fireboats, which are discussed further below.

[15] In fire service parlance, a fire engine or pumper supplements fire hydrant pressure to provide firefighting water for use by its crew, while a ladder truck, or simply truck, carries numerous ladders and other equipment and additional personnel that provide search and rescue, ventilation and other needs.

[16] This was done in the 1989 Loma Prieta earthquake, including putting in service an engine in the Fire Department's Museum. However, post-incident review indicated the capability and amounts of reserve engines, hose and other vital equipment were not satisfactory, and should be improved.

Table 8 SFFD Fire stations and apparatus

Fire Station No. and address	Year station built / re-built	Engine No. and apparatus
1st Battalion		
FS 2 - 1340 Powell Street (Chinatown)	1916 / Re-built 1955	Engine 2 - 2019 Ferrara Igniter (1500/500)
FS 13 - 530 Sansome Street (Financial District)	1975 / Remodeled 2002	Engine 13 - 2017 Ferrara Igniter (1500/500) (SN#H-6112)
FS 28 - 1814 Stockton Street (North Beach)	1913 / Remodeled 1999	Engine 28 - 2002 HME / Ferrara (1500/500/50F) (SN#540)
FS 41 - 1325 Leavenworth Street (Nob Hill)	1910 / Remodeled 1957	Engine 41 - 2017 Ferrara Igniter (1500/500) (SN#H-6113)
2nd Battalion		
FS 1 - 935 Folsom Street (SOMA)	2013	Engine 1 - 2017 Ferrara Igniter (1500/500) (SN#H-6116)
FS 6 - 135 Sanchez Street (The Castro)	1967	Engine 6 - 2014 Spartan ERV Metro Star (1500/500)
FS 29 - 299 Vermont Street (Potrero Hill)	1955	Engine 29 - 2017 Ferrara Igniter (1500/500) (SN#H-6115)
FS 36 - 109 Oak Street (Hayes Valley)	1961	Engine 36 - 2017 Ferrara Igniter (1500/500) (SN#H-6119)
3rd Battalion		
FS 4 - 449 Mission Rock Street (Mission Bay)	2015	Engine 4 - 2014 Spartan ERV Metro Star (1500/500)
FS 8 - 36 Bluxome Street (South Beach)	1939	Engine 8 - 2014 Spartan ERV Metro Star (1500/500)
FS 35 - Pier 22½, 380 The Embarcadero (Embarcadero)	1915	Engine 35 - 2002 HME / Ferrara (1500/500)
FS 48 - 800 Avenue I, Treasure Island (Treasure Island)	2015	Engine 48 - 2006 American LaFrance Eagle (1500/500/20A/20B)
4th Battalion		
FS 3 - 1067 Post Street (Tenderloin)	1916 / Re-built 1974	Engine 3 - 2017 Ferrara Igniter (1500/500) (SN#H-6117)
FS 16 - 2251 Greenwich Street (Marina District)	1956 / Re-built 2018	Engine 16 - 2017 Ferrara Igniter (1500/500) (SN#H-6118)
FS 38 - 2150 California Street (Pacific Heights)	1960	Engine 38 - 2017 Ferrara Igniter (1500/500)
FS 51 - 218 Lincoln Boulevard (Presidio)	1917 / Re-built 2015	Engine 51 - 2005 Pierce Dash (1500/1000)
5th Battalion		
FS 5 - 1301 Turk Street (Fillmore District)	1956 / Re-built 2018	Engine 5 - 2013 Spartan ERV Metro Star (1500/500)
FS 10 - 655 Presidio Avenue (Presidio Heights)	1956	Engine 10 - Spartan Gladiator / Crimson (1500/500)
FS 12 - 1145 Stanyan Street (Haight-Ashbury)	1956	Engine 12 - 2006 American LaFrance Eagle (1500/500/20A/20B)
FS 21 - 1443 Grove Street (Panhandle)	1958	Engine 21 - 2014 Spartan ERV Metro Star (1500/500)
6th Battalion		

Fire Station No. and address	Year station built / re-built	Engine No. and apparatus
FS 7 - 2300 Folsom Street (Mission District)	1954	Engine 7 – 2014 Spartan ERV Metro Star (1500/500)
FS 11 - 3880 26th Street (Noe Valley)	1958	Engine 11 - 2013 Spartan ERV Metro Star (1500/500)
FS 24 - 100 Hoffman Avenue (Dolores Heights)	1914	Engine 24 - 2006 American LaFrance Eagle (1500/500/20A/20B)
FS 26 - 80 Digby Street (Glen Park)	1968	Engine 26 -
FS 32 - 194 Park Street (Bernal Heights)	1942	Engine 32 - 2002 HME / Ferrara (1500/500)
7th Battalion		
FS 14 - 551 26th Avenue (Central Richmond)	1958 / Remodeled 1998	Engine 14 - 2014 Spartan ERV Metro Star (1500/500)
FS 22 - 1290 16th Avenue (Inner Sunset)	1962	Engine 22 - 2006 American LaFrance Eagle (1500/500/20A/20B)
FS 31 - 441 12th Avenue (Richmond District)	1913 / Remodeled 1957 and 1969	Engine 31 - 2006 American LaFrance Eagle (1500/500/20A/20B)
FS 34 - 499 41st Avenue (Outer Richmond)	1928 / Re-built 1957	Engine 34 - 2014 Spartan ERV Metro Star (1500/500)
8th Battalion		
FS 18 - 1935 32nd Avenue (Sunset District)	1951	Engine 18 - Spartan Gladiator / Crimson (1500/500)
FS 20 - 285 Olympia Way (Midtown Terrace)	1963	Engine 20 - Spartan Gladiator / Crimson (1500/500)
FS 23 - 1348 45th Avenue (Outer Sunset)	1912 / Remodeled 1957	Engine 23 -
FS 40 - 2155 18th Avenue (Golden Gate Heights)	1931 / Remodeled 1956	Engine 40 -
9th Battalion		
FS 15 - 1000 Ocean Avenue (Ingleside)	1957	Engine 15 - 2010 Spartan Metro Star / Crimson (1500/500/20F)
FS 19 - 390 Buckingham Way (Lakeside)	1953	Engine 19 - 2014 Spartan ERV Metro Star (1500/500)
FS 33 - 8 Capitol Avenue (Oceanview)	1974	Engine 33 - 2018 Ferrara Igniter (1500/500)
FS 39 - 1091 Portola Drive (Forest Hill)	1923 / Remodeled 1955	Engine 39 - 1998 Spartan Gladiator / 3D (1500/500) (Ex-Engine 2)
FS 43 - 720 Moscow Street (Excelsior)	1970	Engine 43 - 2017 Ferrara Igniter (1500/500) (SN#H-6114)
10th Battalion		
FS 9 - 2245 Jerrold Avenue (Bayview)	1974	Engine 9 -
FS 17 - 1295 Shafter Avenue (Bayview)	1956 / Remodeled 1996	Engine 17 - 2018 Ferrara Igniter (1500/500)
FS 25 - 3305 3rd Street (India Basin)	1927 / Remodeled 1998	Engine 25 -
FS 37 - 798 Wisconsin Street (Potrero Hill)	1914 / Remodeled 1997	Engine 37 -

Fire Station No. and address	Year station built / re-built	Engine No. and apparatus
FS 42 - 2430 San Bruno Avenue (Portola)	1912 / Remodeled 1953	Engine 42 -
FS 44 - 1298 Girard Street (Vistacion Valley)	1913	Engine 44 - Spartan Gladiator / Crimson (1500/500)

SFFD has approximately 1450 uniformed firefighters, including Chief of Department, officers and firefighters. Each duty shift typically has about 300 officers and firefighters, not counting non-firefighter paramedics and EMTs on SFFD ambulances. SFFD also maintains a volunteer San Francisco Fire Reserve (http://sffd-fire-reserve.org/) that currently numbers approximately 30 personnel, and who are very useful at support tasks such as deploying 5" hose, portable hydrants, picking up hose, etc – however, they have no actual firefighting or rescue experience. Many firefighters live outside the City. In 1989 a general recall order was issued, and many SFFD personnel responded within several hours, including many who had not actually heard of the recall order.

SFFD also supports the Neighborhood Emergency Response Team (NERT, https://sf-fire.org/nert) program. NERT is a free training program for individuals, neighborhood groups and community-based organizations in San Francisco, through which individuals learn the basics of personal preparedness and prevention. The training includes hands-on disaster skills that will help individuals respond to a personal emergency as well as act as members of a neighborhood response team. Since 1990 the NERT program has trained more than 17,000 San Francisco residents to be self-reliant in a major disaster.

The Hose Tender provides an above ground portable water supply system. This system can be strategically placed to provide adequate flow and pressure for firefighting when other sources of water supply fail or are not available.

Figure 62 Typical SFFD (top) fire engine; (bott) hose tender
Source: (SFFD 2009)

3.4.2 Mutual aid

Mutual aid is the lending of firefighting assistance across jurisdictional boundaries when circumstances require. SFFD has agreements to provide and receive mutual aid from neighboring jurisdictions, and this has occurred for example when SFFD responded to Oakland in the 1991 East Bay Hills fire.

In a large disaster such as the scenarios of this study, SFFD would receive mutual aid but most likely not from nearby departments, since most departments in the Bay Area would be fully committed within their own jurisdictions. Therefore, mutual aid would from the Central Valley and Southern California, after a number of hours, coordinated by the Governor's Office of Emergency Services (OES), who are well practices in this. This delay would be due not only to the distance but because transportation routes would be likely to sustain some partial dysfunction due both to damage as well as congestion.

As discussed above, this study assumed no mutual aid for the first 12 hours with mutual aid strike team arrivals every two hours for the period 12-24 hours, and as many engines as needed after 24 hours. Aerial attack by tanker aircraft as typically used in wildland fires, is unlikely in San Francisco and is not considered in the analysis. These resource and operational aspects of the modeling were reviewed and approved by SFFD senior Chiefs.

3.5 WATER SUPPLY

This section discusses the various sources of water that SFFD would access for firefighting purposes.

3.5.1 Potable water system

Under normal circumstances at a fireground, SFFD accesses water from a fire hydrant, either an EFWS high-pressure network or a potable water system hydrant. The potable system, termed the Municipal Water Supply System (MWSS) provides water from 18 different reservoirs and a number of smaller storage tanks. The water is stored at different levels, creating zones, or districts, where water is distributed within certain ranges of pressures. There are 23 different pressure districts, of which the Sunset and University Mound Reservoir Systems are the largest. The pipelines in this portion of the feeder main network range in diameter from 10 to 60 in. and vary in composition from riveted and welded steel to cast iron. There are approximately 300 mi. of feeder pipelines in the Municipal System. Distribution pipelines are principally 4, 6, and 8 in. in diameter. They receive water from the feeder main network for delivery to hydrants and buildings. There are approximately 850 mi. of distribution piping in the Municipal System.

In the 1989 Loma Prieta earthquake, damage was relatively low throughout the Municipal System in areas outside the Marina, with a total of 30 breaks. Within the Marina, there were 123 repairs in an area with approximately 37,000 ft. of pipelines belonging to the Municipal System (and 7,500 ft. of pipelines belonging to the EFWS high-pressure network) (O'Rourke 1990).

As discussed in the CAPSS technical documentation (ATC-52-1A 2010), the MWSS is likely to suffer numerous breaks and leaks such that substantial numbers of its hydrants will be without water for firefighting. For this reason, the MWSS was not considered as a source of water for firefighting for this study. The precise serviceability of the MWSS given a major earthquake is a vital question for San Francisco and should be investigated.

3.5.2 EFWS

The EFWS was described above and currently consists of the high-pressure network (i.e., the static supplies, pump stations and pipe network), cisterns, suction connections and fireboats. In future, the EFWS may include additional pipes and pump stations in other parts of the City. For purposes of this analysis, after considerable study, a phased construction of additions was identified, as reasonably representing what is required. These additions were to occur in three phases, as shown in Figure 63 and Figure 64. It is emphasized that these phases are a reasonable postulate of how the EFWS might be expanded, and that the expansion of the EFWS could take many other forms.

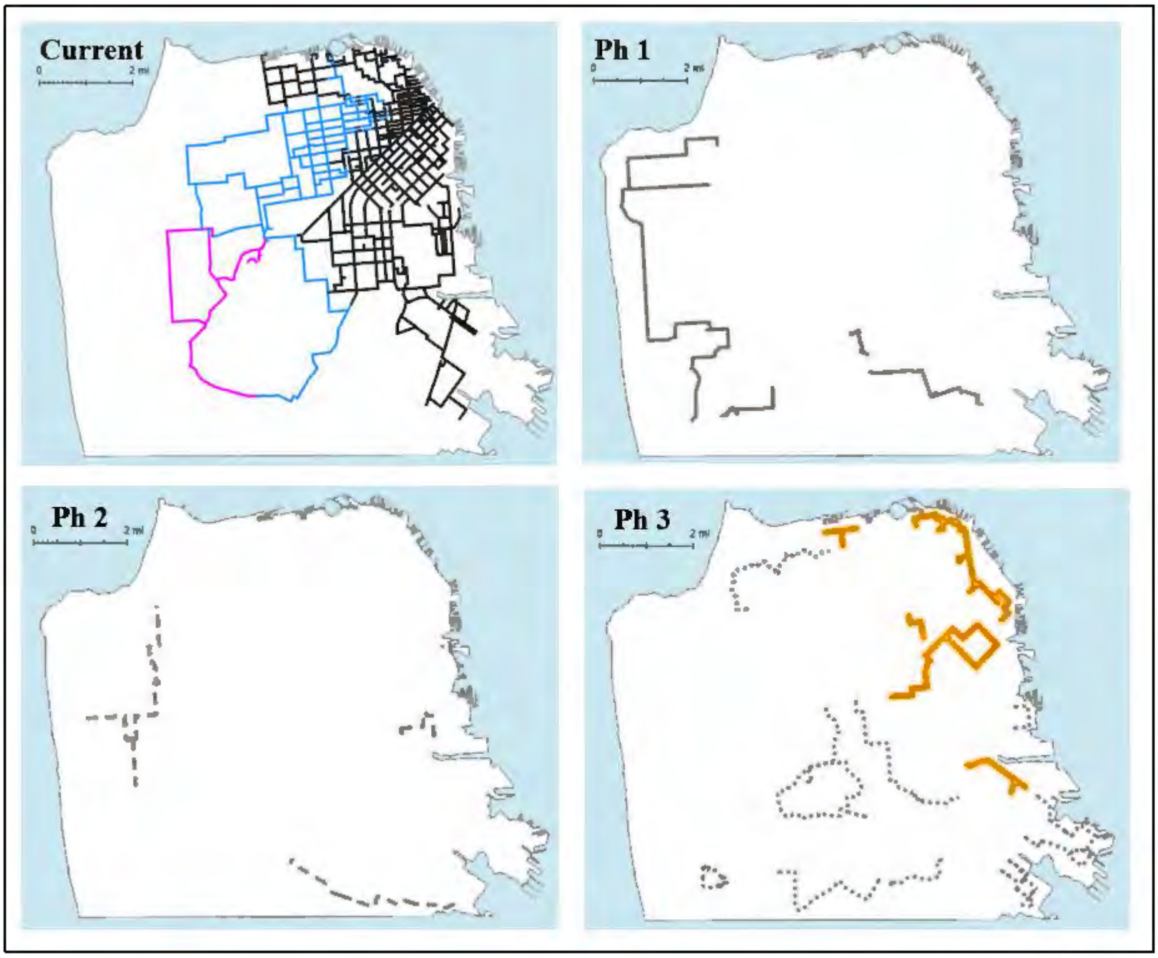


Figure 63 EFWS current and future phases: (top left) current; (top right) phase 1; (lower left) phase 2; (lower right): phase 3.

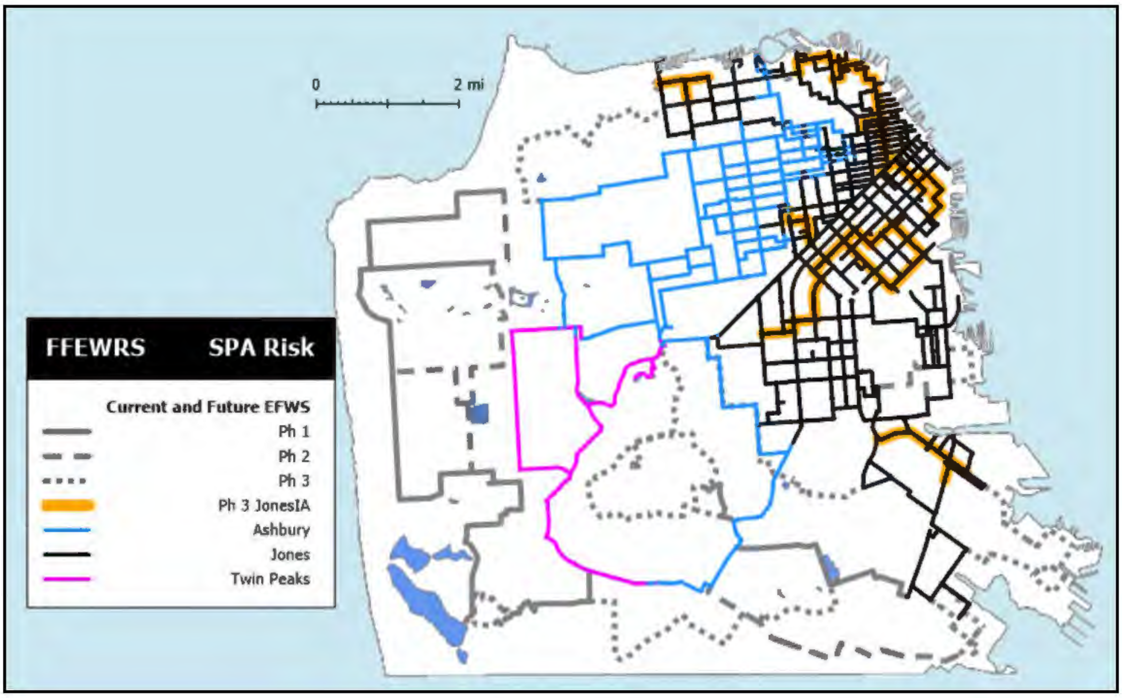


Figure 64 EFWS all phases combined

3.5.3 Alternative water supplies

In addition to the MWSS and EFWS high-pressure network, a number of alternative water supplies exist in the City, which SFFD in extremis might employ for firefighting, as shown in Figure 65, and include various lakes, reservoirs and suction connections. All of these were included in the analysis.

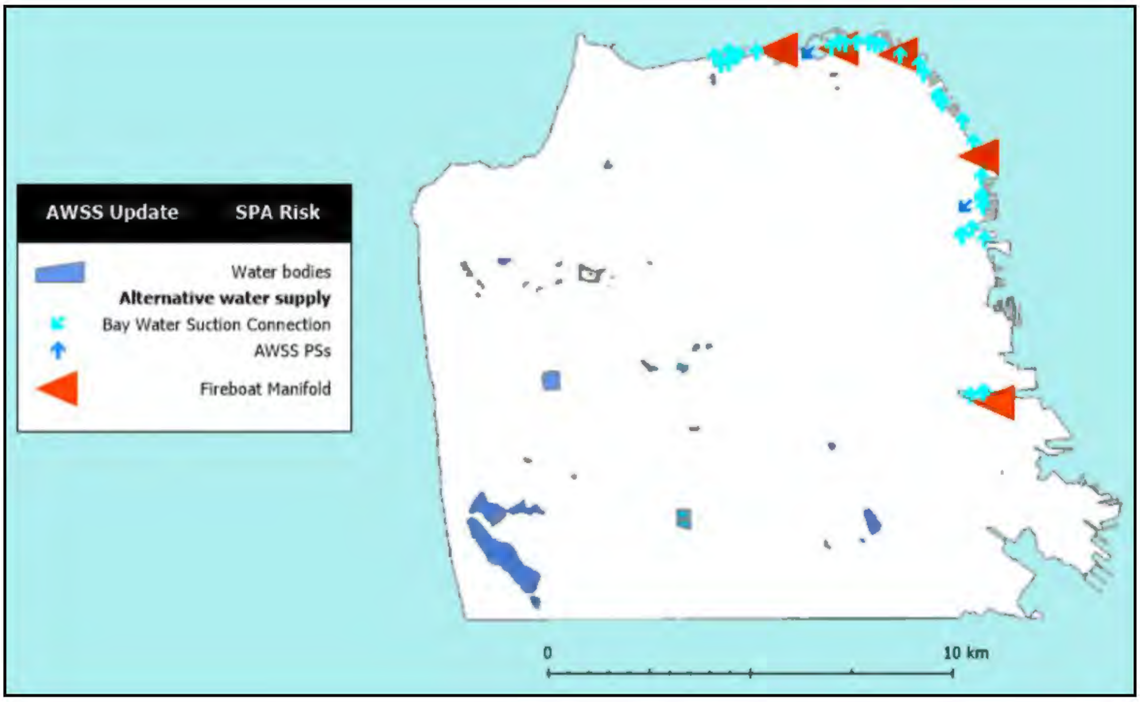


Figure 65 Alternative water supplies

3.5.4 Presidio

Data on the Presidio water system was acquired and georeferenced, as shown in Figure 66 below.

Figure 66 Presidio water system georeferenced with hydrants shown as blue-yellow triangles.

3.6 Streets and access

SFPUC personnel will have to travel to locations of EFWS damage, and SFFD must travel to fires, so data was gathered on the City's streets, Figure 67 and Figure 68.

A particular issue is that San Francisco has a large number of streets with overhead wires, such as the overhead trolley lines in Figure 69, which may fall and block streets, hindering emergency response. Streets with overhead SFMTA lines are shown in Figure 70 and streets where overhead electric distribution lines have been "undergrounded" are shown in Figure 71.

The issue of overhead wires was examined but is not explicitly incorporated in this study's modeling and may deserve further attention.

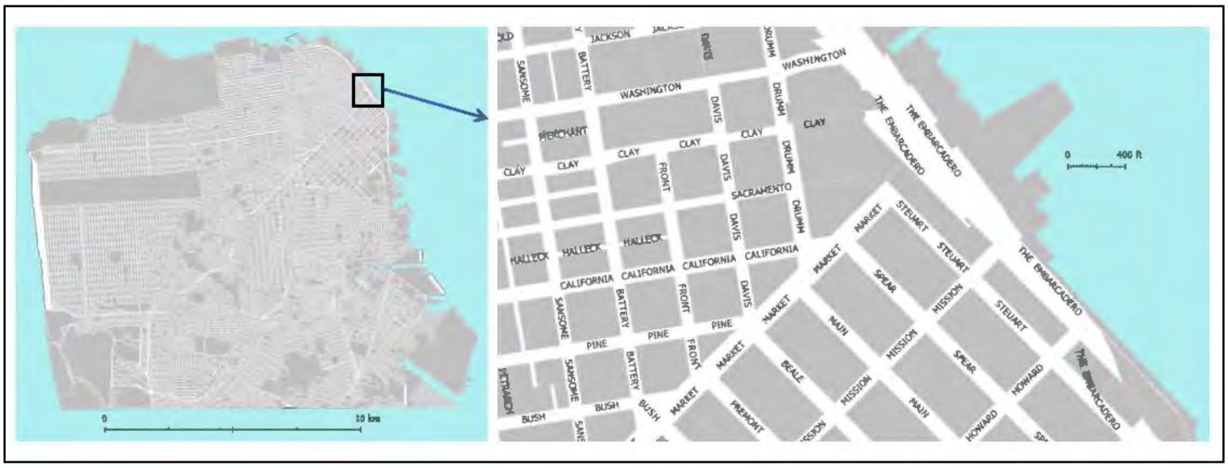


Figure 67 Street data

Figure 68 Street width (building face-building face) sampled from Google Earth (example: 27th Ave between Moraga and Noriega).

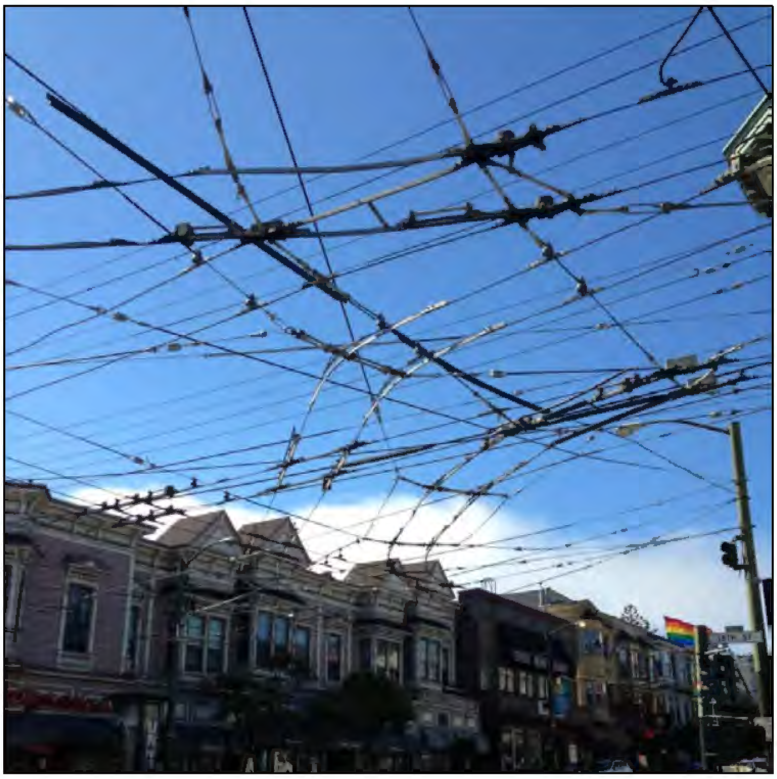


Figure 69 Example of complex overhead wire arrangement, Castro District
(Source: Google Street View)

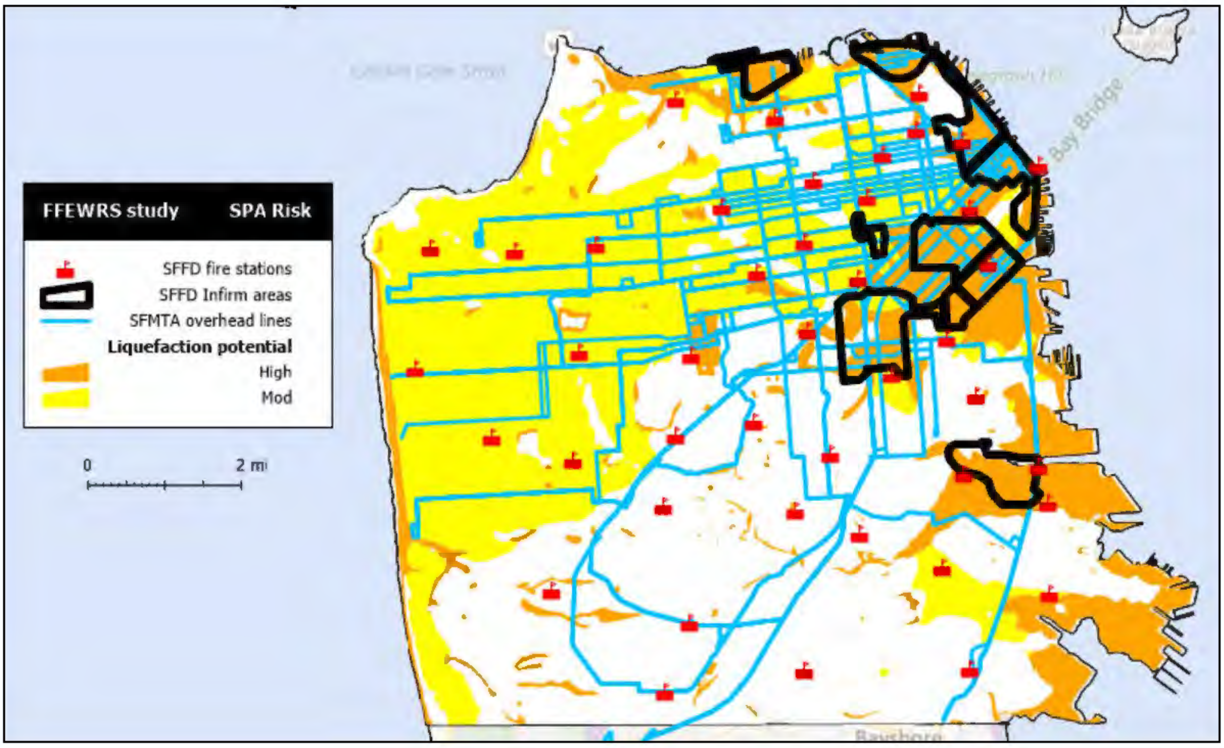


Figure 70 SFMTA overhead wires shown in blue and SFFD fire stations (red symbols) overlaid on liquefaction potential and SFFD Infirm Areas.

Figure 71 San Francisco 'undergrounded' streets shaded in red (i.e., streets in red have no overhead electric distribution lines) Source: https://bsm.sfdpw.org/mapviewer/

3.7 Weather

Weather is an important factor in firespread, so data was collected from a variety of sources for San Francisco temperature, windspeed and direction, relative humidity and precipitation. The primary dataset was hourly observations of humidity, temp, pressure and wind for the five-year period 2012-2017. This was supplemented with total daily precipitation for the period 1921-2019. Figure 72 to Figure 74 summarize the data.

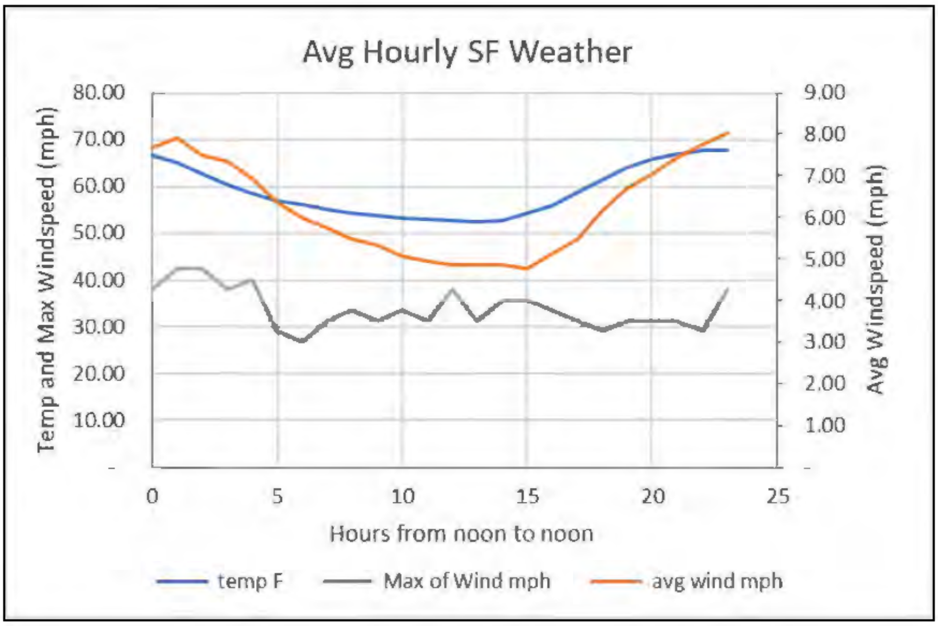


Figure 72 Variation of San Francisco mean temperature, maximum windspeed and mean windspeed, hourly observations 2012-2017 (n = 44,489)

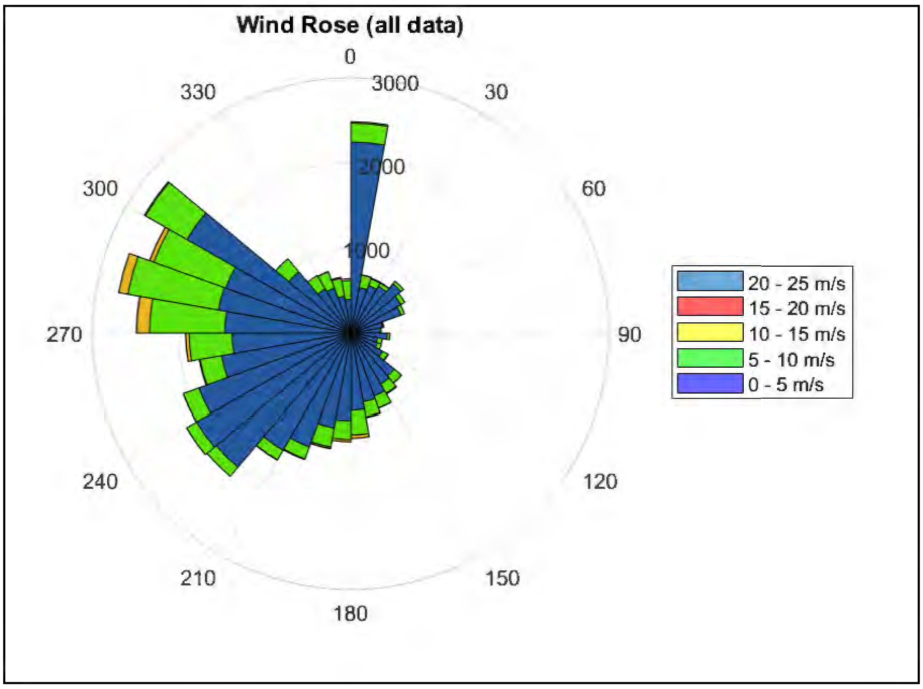


Figure 73 Wind rose of San Francisco winds, all hours

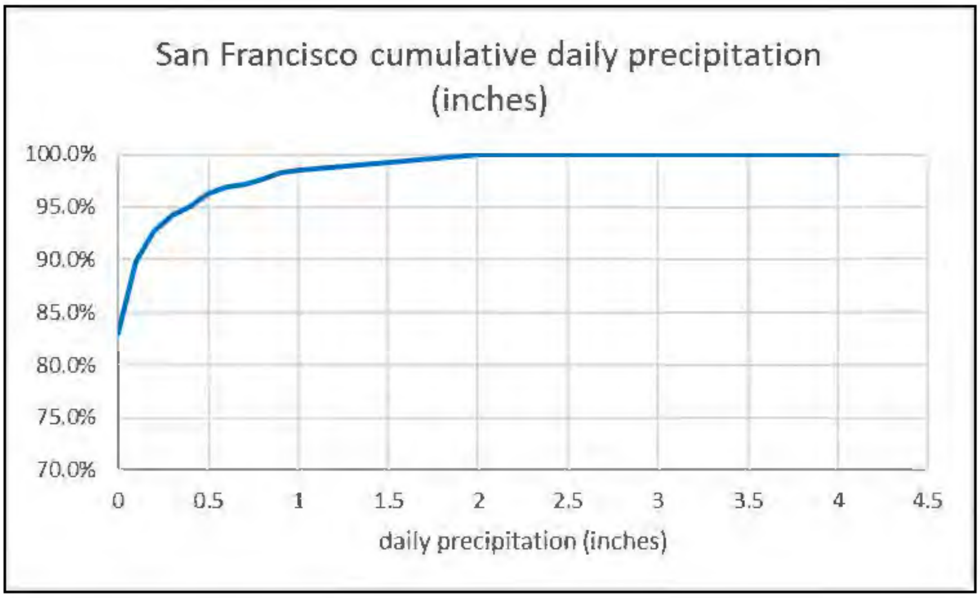


Figure 74 Cumulative distribution of San Francisco daily precipitation (inches). About 82% of days there is no precipitation.

4 FIRE FOLLOWING EARTHQUAKE: ANALYSIS AND MODELING

Methods and algorithms employed in the project are summarized.

4.1 INTRODUCTION

The modeling of ignition, growth and spread of fires, and firefighting to suppress those fires, has been performed within a Monte Carlo simulation framework for this study. The Monte Carlo method evolved in the 1930s and 40s as part of the work on atomic energy, is well documented (Zio 2013) and essentially consist of numerous repetitions of a stochastic model, with each replication of the model using fixed values of the stochastic variables. The fixed values of the variables are determined by randomly sampling each variable's underlying probability distribution function. The essence of the approach then is developing a model and deciding which variables in the model are uncertain and thus require sampling. This section first provides an overview of the underlying model for analysis of fire following earthquake, and then discusses specifics of the modeling performed in this study.

4.2 Analysis of fire following earthquake

4.2.1 Overview

The first step towards solving any problem is analyzing the problem and quantifying its effects. A full probabilistic methodology for analysis of fire following earthquake was developed in the late 1970s (Scawthorn, Yamada and Iemura 1981) and has been applied to major cities in western North America (Scawthorn 1992). An American Society of Civil Engineers' monograph (Scawthorn, Eidinger and Schiff 2005) details the state of the art in modeling fire following earthquake. Previously, fire following earthquake was modeled for the CAPSS project where the focus was on property loss, not water use. Given these sources, only a brief review of the general modeling of fire following earthquake is presented here, with additional detail as needed related to water use. In summary, the steps in the process are shown in Figure 75:

- *Occurrence of the earthquake* –causing damage to buildings and contents, even if the damage is as simple as knocking things (such as candles or lamps) over.
- *Ignition* – whether a structure has been damaged or not, ignitions will occur due to earthquakes. The sources of ignitions are numerous, ranging from overturned heat sources, to abraded and shorted electrical wiring, to spilled chemicals having exothermic reactions, to friction of things rubbing together.
- *Discovery* – at some point, the fire resulting from the ignition will be discovered, if it has not self-extinguished (this aspect is discussed further, below). In the confusion following an earthquake, the discovery may take longer than it might otherwise.
- *Report* – if it is not possible for the person or persons discovering the fire to immediately extinguish it, fire department response will be required. For the fire department to respond, a Report to the fire department has to be made. Communications system dysfunction and saturation will delay many reports.
- *Response* – the fire department then has to respond, but are impeded by non-fire damage emergencies they may have to respond to (e.g., building collapse) as well as transportation disruptions.

- *Suppression* – the fire department then has to suppress the fire. If the fire department is successful, they move on to the next incident. If the fire department is not successful, they continue to attempt to control the fire, but it spreads, and becomes a conflagration. Success or failure hinges on numerous factors including water supply functionality, building construction and density, wind and humidity conditions, etc. If unable to contain the fire, the process ends when the fuel is exhausted or when the fire comes to a firebreak.

This process is also shown in Figure 76, which is a Fire Department Operations Timeline. Time is of the essence for the fire following earthquake problem. In this figure, the horizontal axis is Time, beginning at the time of the earthquake, while the vertical axis presents a series of horizontal bars of varying width. Each of these bars depicts the development of one fire, from ignition through growth or increasing size (size is indicated by the width or number of bars). Fire following earthquake is a highly non-linear process, modeling of which does not have great precision and is such that in many cases the only clear result is differentiation between situations of a few small fires, versus major conflagration.

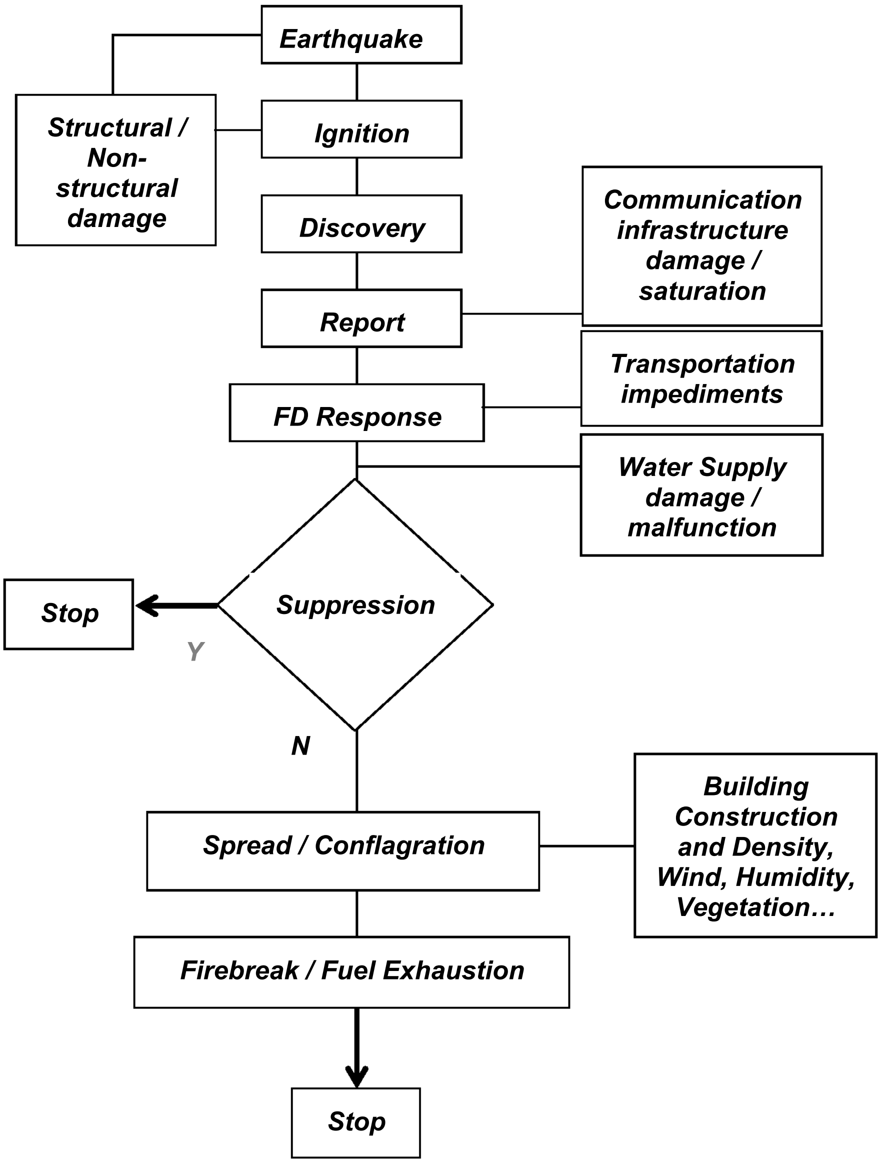


Figure 75 Flow chart of fire-following-earthquake process (TCLEE 2005)

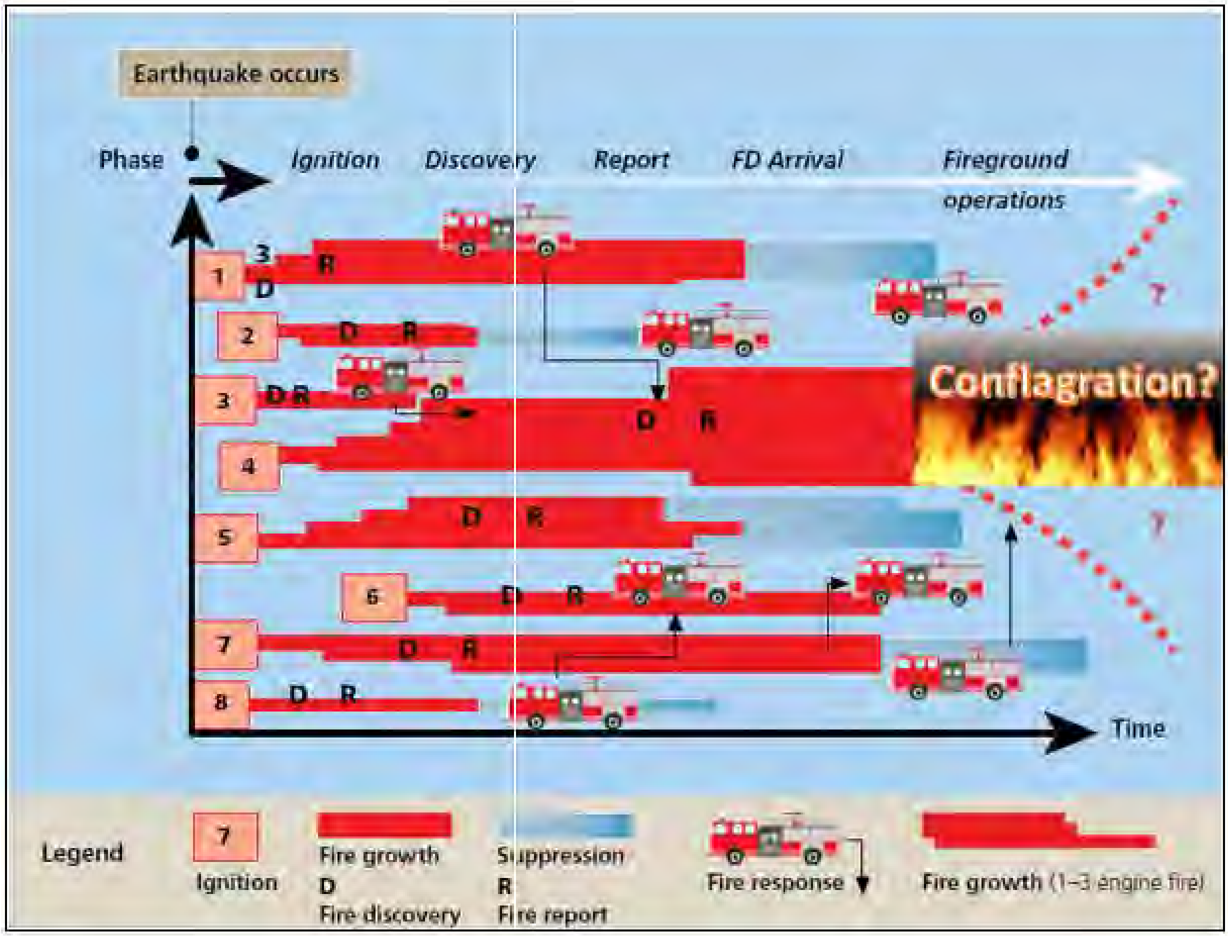


Figure 76 Chart of fire department operations time line. Horizontal axis is time, beginning at time of earthquake. Horizontal bars depict development of fires, from ignition through growth or increasing size (size is indicated by width or number of horizontal bars).(Scawthorn 1987)

4.2.2 Ignitions

The number and pattern of ignitions are estimated for each block in the city based on intensity of ground motion, TFA and ignition relationship shown in Figure 77 which is based on methods in (SPA Risk 2009) which are further discussed in (Scawthorn 2018a). Figure 78 compares the relationship with a model by Davidson. The cause of these ignitions will likely be similar to causes in the 1994 Northridge earthquake, which is the best US data set for recent fires following an earthquake – about half of all ignitions would be electrical related, a quarter gas-related, and the other due to a variety of causes, including chemical reaction, Also based on the Northridge experience, about half of all ignitions would typically occur in single family residential dwellings, with another 26% in multi-family residential occupancies – that is, about 70% of all ignitions occur in residential occupancies. Educational facilities would be a small percentage of all ignitions (3% in Northridge), and most of these are due to exothermic reactions of spilled chemicals in chemistry laboratories.

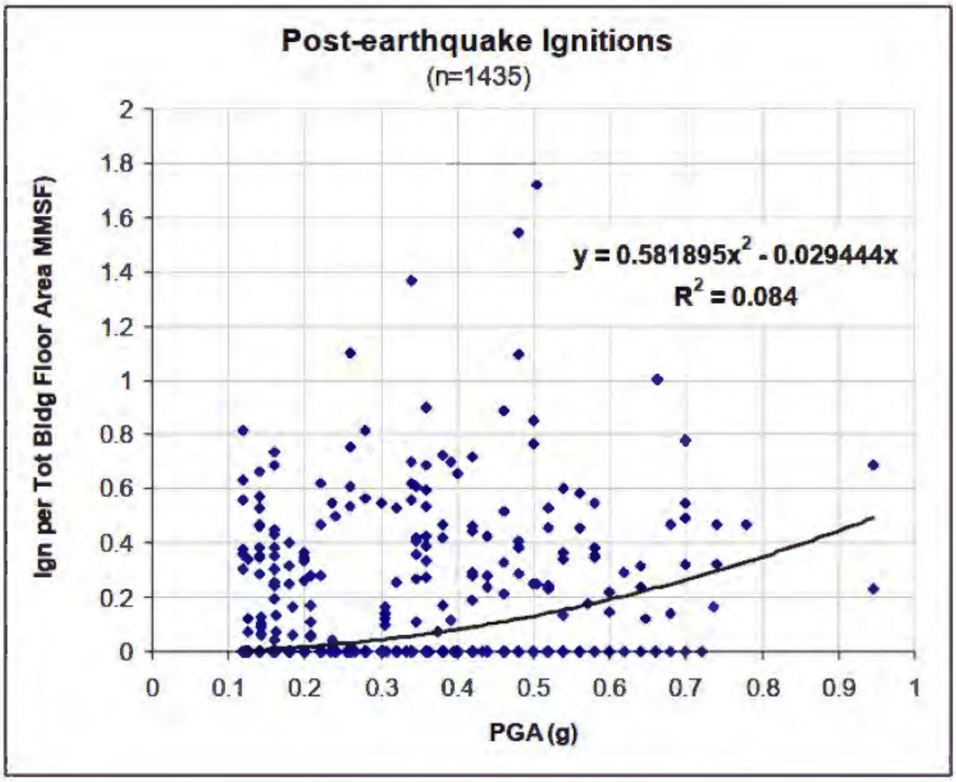


Figure 77 Ignition models, taken from (SPA Risk 2009) (MMSF is millions of square feet).

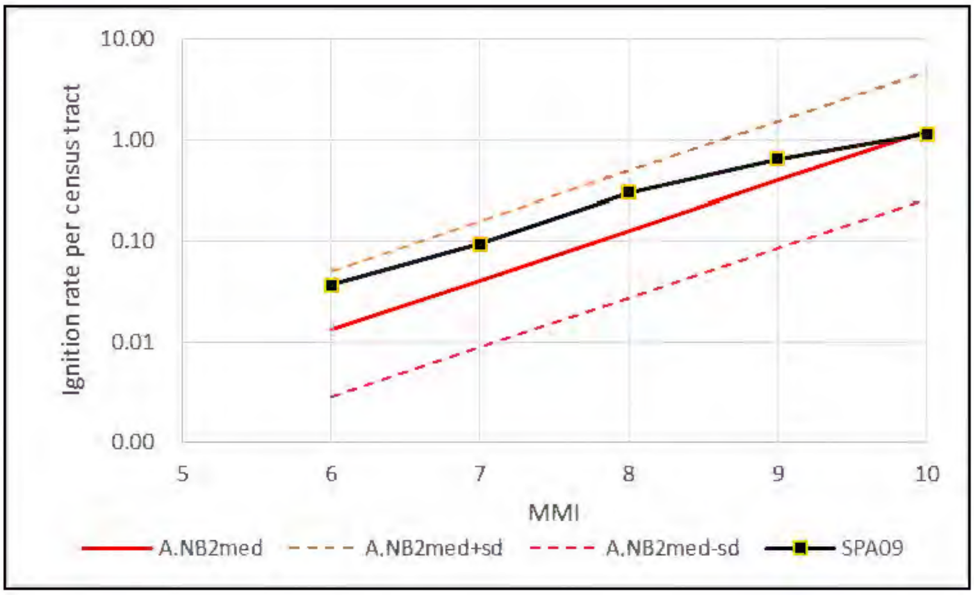


Figure 78 Ignition models, comparison of ignition regression models (1) [Davidson 2009] and (3) [SPA 2009] using median values per census tract. Dotted lines are equation (1) plus and minus one standard deviation. Abscissas in the figure are Modified Mercalli Intensity (MMI), but analysis for this study employed peak ground acceleration (PGA) as the hazard measure.

4.2.3 Initial Response

4.2.3.1 Citizen response

Ignitions requiring fire department response will initially be responded to by citizens – as noted, they will be able to suppress some fires, which are not included in the estimates of fires. When citizens realize the fire is beyond their capabilities, they will endeavor to call the fire department, by telephone since fire alarm street pull boxes have largely disappeared from the North American urban landscape. Attempts to report via 911 will almost universally be unsuccessful, not so much due to damage to the telephone system as much as simple saturation of the system, and 911 call centers. Citizens will then go by auto to the nearest fire station, but such 'still alarms' will be largely unneeded, since the fire companies will have already responded to the nearest fire ("self-dispatched"), if not dispatched by 911.

Experience shows that citizens on scene will respond rationally (Van Anne, Scawthorn and Mileti 1994) rescuing as many people as possible and protecting exposures. Water supply from mains may be unavailable.

4.2.3.2 Reporting

As noted above, 911 centers will be overwhelmed, and doing as much as possible to triage events and dispatch resources. Reports of fires during the initial period will be haphazard. Most fire departments do not have their own helicopters, and TV helicopter news reporting will be a valuable resource for a few major incidents, but not most. An anecdote demonstrates this – the first knowledge the San Francisco Fire Department EOC had of the Marina fire in the 1989 Loma Prieta earthquake was from television news reports (despite several companies having responded). Quickly gaining an accurate complete situational awareness is still a challenge.

4.2.3.3 Fire Service initial response

The initial response of fire companies and personnel in the study area will be to protect themselves during violent shaking, and as soon as possible open the doors and remove apparatus (e.g., pumpers and ladder trucks) from the fire stations. Different departments have somewhat varying earthquake procedures but in general companies will remove apparatus to a pre-designated location, often simply in front of the fire station, check the station for damage and perform a radio check. By this time, typically within five minutes, they will either have self-dispatched to an observed smoke column, responded to a citizen still alarm, or been instructed to mobilize with other companies into a strike team.

Debris, downed wires and other damage may block some roads and impede access to fire sites, although San Francisco's street pattern is sufficiently redundant such that added travel time will be limited to a few minutes (Kiran and Corcoran 2017), typically less than time lost due to delayed reporting.

Local fire service resources will be completely committed, and in need of mutual aid. The primary needs will be personnel, additional hose, hard suction hose (that is, hose that does not collapse when used to draft water from a source that is not already under pressure), foam, light equipment (gloves, hand tools, self-contained breathing apparatus [SCBA]) and heavy equipment (cranes, bulldozers, backhoes). Additional fire apparatus (pumpers and ladder trucks) will not be the primary need, initially, but will still prove useful as extra-regional strike teams arrive.

In the initial stage, personnel needs may be significantly supplemented by Neighborhood Emergency Response Teams (NERT) but will be more significantly strengthened by the recall of off-duty trained firefighters. Off-duty personnel can be expected to have doubled staffing within 3-6 hours and tripled it within 12-24 hours. While responding, an issue will be how these personnel marry up with their companies, and there will be some inefficiencies as personnel join first available companies. Nevertheless, arrival of off-duty personnel will be very important, to spell on-duty personnel nearing their physical limits.

Time of arrival at the fire by a fire engine is then based on the time of ignition following the earthquake, plus a period for reporting taken as the travel time (vehicular travel) from the fire to the nearest fire station, plus the same travel time back to the fireground by the fire engine. If the fire engine assigned to that fire station has already committed to another fire, the travel time is then taken as that of the nearest available engine.

4.2.4 Water supply performance

The availability of water for firefighting is crucial and is discussed here.

4.2.4.1 Water Supply Factor

The availability of water at a fireground is determined based on the stochastic variable WSF (Water Supply Factor), which varies from 0 (no water) to 1 (sufficient water for firefighting). The WSF is determined as the probabilistic combination of constituent WSF_i where i = EFWS high-pressure network (HP), Cisterns and Alternative Water Supplies. That is,

$$WSF = 1 - \prod (1 - WSF_i) \qquad \text{Equation 1}$$

Determination of WSF_{HP} based on the approach in Hazus (DHS 2003) as enhanced by Porter (Porter 2018), where serviceability *s(r)* is a function of pipe repair rate *r* normalized by pipe length *L,* ln denotes natural logarithm, r/L denotes the average break rate (r main breaks per L kilometer of pipe), q and b are model parameters, and Φ is the standard normal cumulative distribution function:

$$s(r) = 1 - \Phi\left(\frac{\ln((r/L)/q)}{b}\right) \qquad \text{Equation 2}$$

That is, $WSF_{HP} = s(r)$, and its determination reduces to estimating pipe repair rate of the EFWS high-pressure network pipe for the scenario earthquake. The EFWS high-pressure network overlaid on areas of high likelihood PGD is shown in Figure 79, and the number and pattern of repairs and breaks are shown in Figure 80 and Figure 81, respectively.

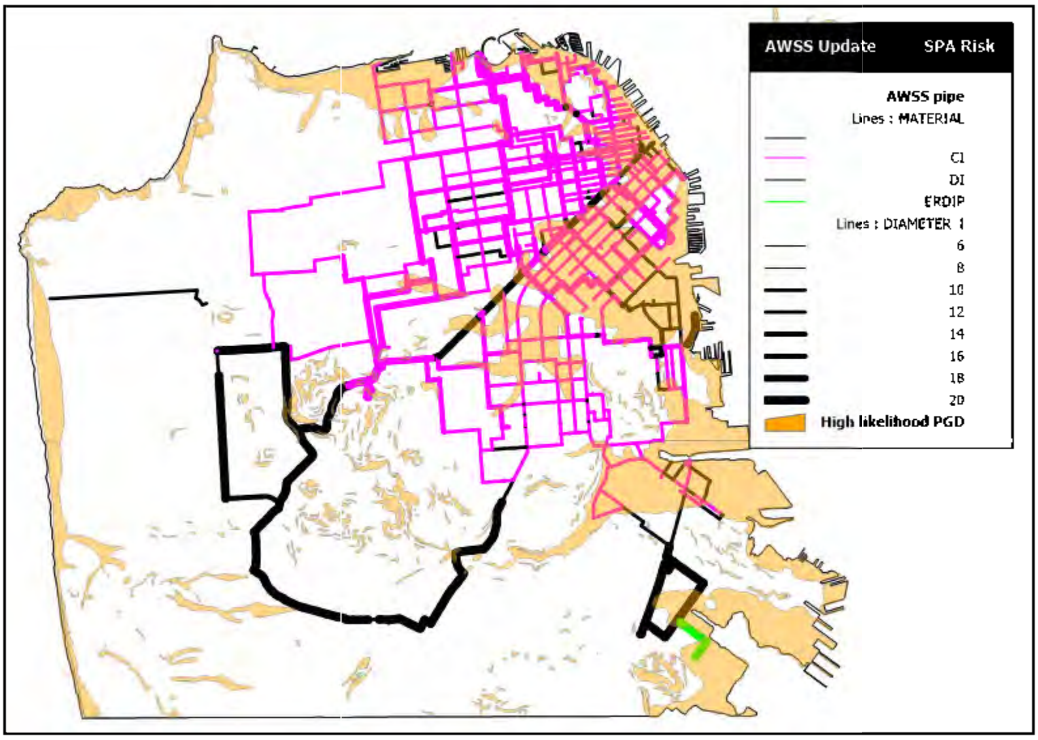


Figure 79 EFWS high-pressure network pipe network overlaid on areas of high likelihood PGD

For details of this approach, and the values of q and b, and methods for estimating pipe repairs and breaks, see (Porter 2018). For each trial of a Monte Carlo simulation then, Equation 2 is used to estimate the serviceability of each zone of the EFWS high-pressure network. This serviceability is then multiplied by a factor based on distance from the pipeline, to account for the probability of SFFD ability to access the EFWS high-pressure network hydrant (the further from the hydrant, the less likely SFFD will be able to convey water from the hydrant to the fireground, under post-earthquake conditions).

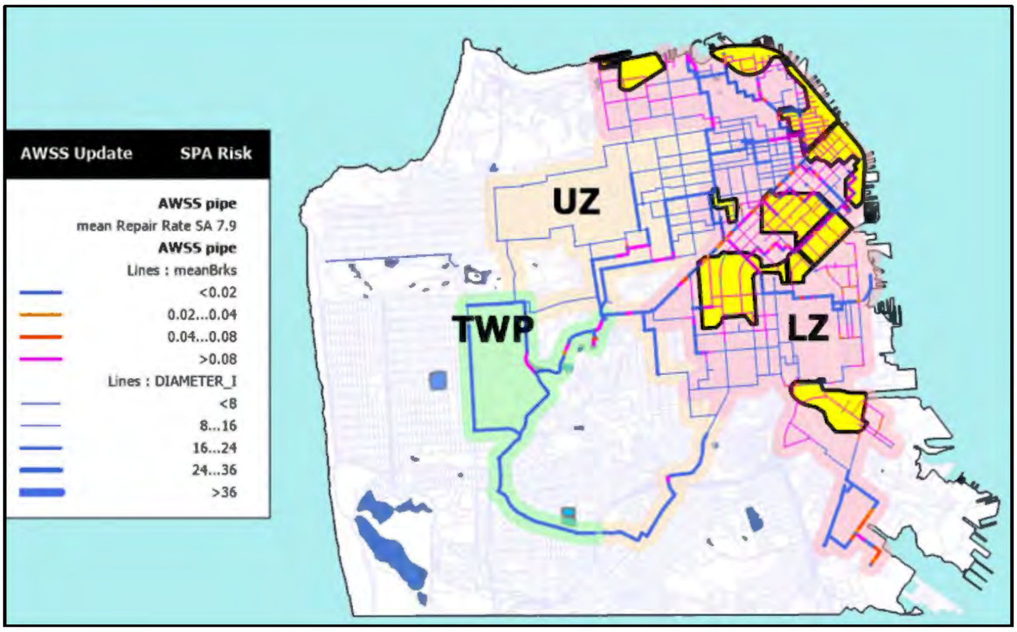


Figure 80 Mean **repair** rate for SA 7.9 event – mean number of repairs is 105, of which 52 are within the SFFD identified Infirm Areas – that is, 53 will not be isolated by current seismically actuated motorized gate valves. LZ denotes the Lower Zone, UZ the Upper Zone and TWP the Twin Peaks Zone.

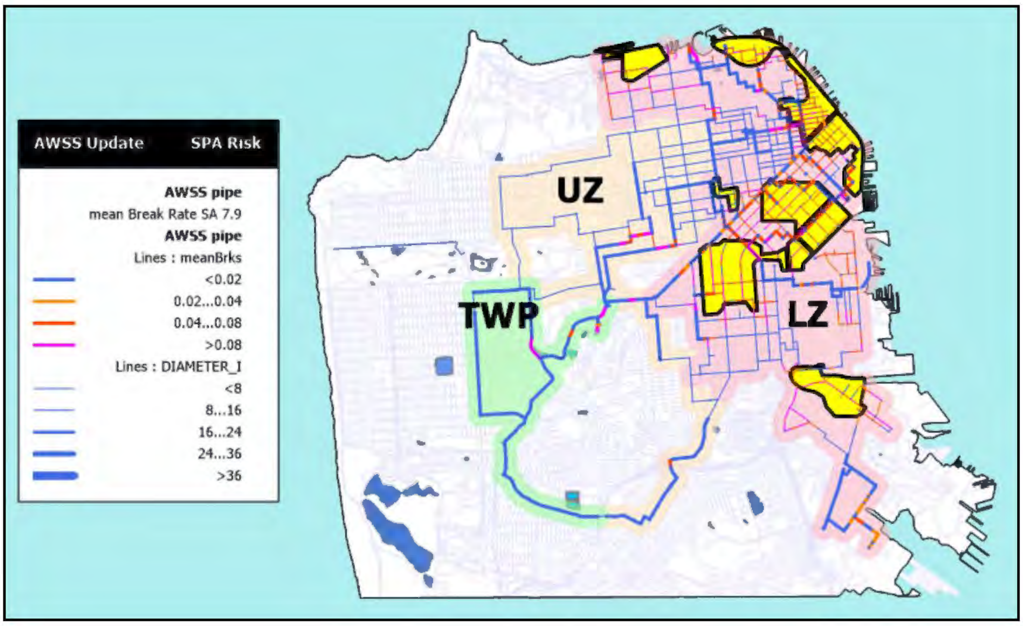


Figure 81 Mean **break** rate for SA 7.9 event – mean number of breaks is 52, of which 26 are within the SFFD identified Infirm Areas– that is, 26 will not be isolated by current seismically actuated motorized gate valves.

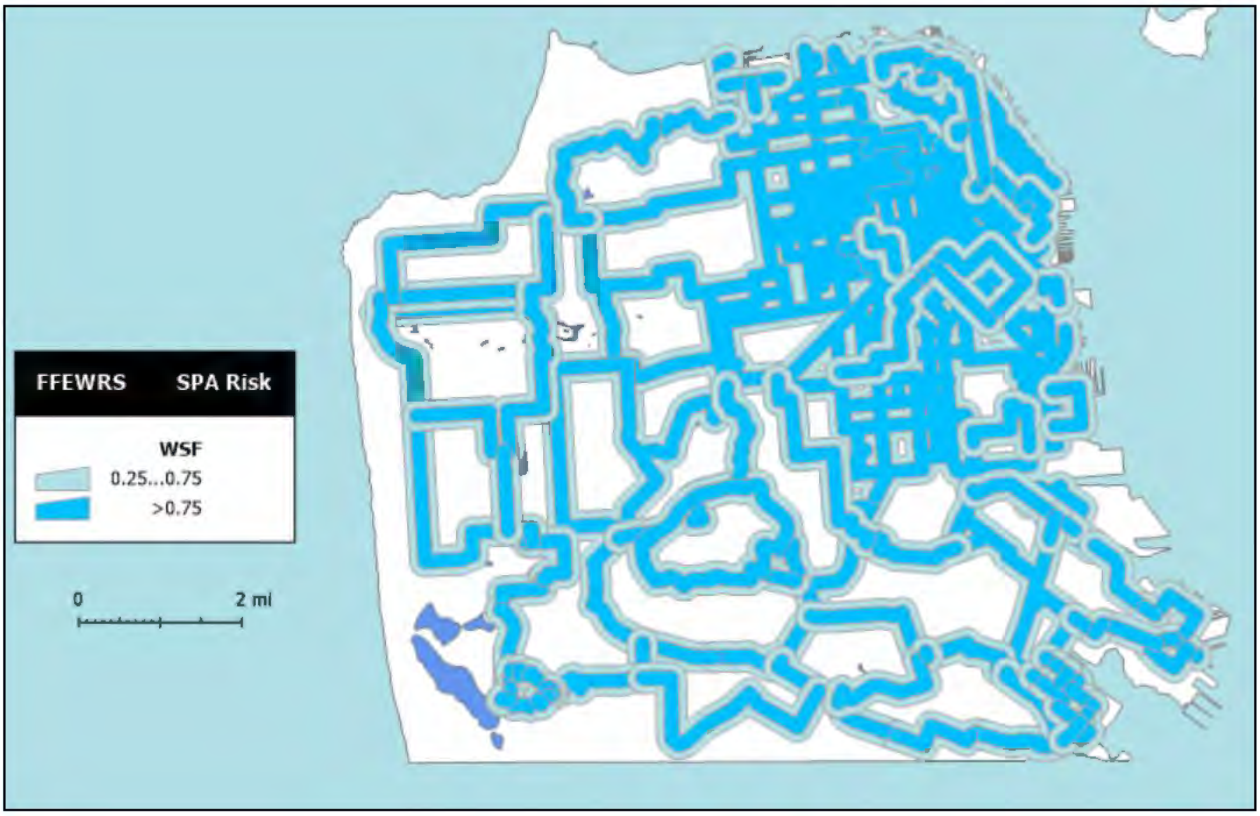


Figure 82 EFWS WSF, at Phase 3 buildout

The above accounts for the physical serviceability of the EFWS high-pressure network. However, as seen in 1989, the physical serviceability can be further affected by operational factors. That is, the potential exists for EFWS high-pressure network operators to rapidly isolate damage to the network and maintain system functionality or, on the other hand, respond more slowly, which may allow the system to dewater, resulting in a prolonged delay until pressure can be restored. The latter is what happened in the 1989 Loma Prieta earthquake – operators had only about 20 minutes to respond (Scawthorn 1990b).

To account for this operational aspect, the WSF_{HP} as determined above is modified as a function of time following the earthquake by two factors, *sysEFF* and t_{REC}. That is, system serviceability (i.e., $WSF_{HP} = S(t)$) is modeled using a generalized logistic function:

$$S(t) = S(0) + \frac{1 - S(0)}{[1 + \exp\left(-sysEff * t\right]^{t_{Rec}}}$$

Equation 3

where

S(t) is Serviceability at time *t*

sysEFF is system efficiency (ie, ability to restore serviceability following earthquake) which varies from 0 (very poor) to 1 (excellent recovery)

t_{REC} is time to near-complete recovery. Reasonable times to recovery for Low, Moderate and High are shown in the table below. Note that $t_{REC} = 6/sysEff$.

Three levels of EFWS system efficiency are considered in the analysis, Table 9, with consequences as shown in Figure 83:

Table 9

System Efficiency	EFWS system command and control	*sysEff*	t_{REC} (hrs)
Low	unable to gain situational awareness in timely manner and/or make and implement decisions to improve EFWS performance. Effectively, pre-event configuration unchanged for significant period (cannot isolate breaks)	0.25	24
Moderate	Gains situational awareness over time (e.g., via reports) and can isolate EFWS damage and compensate via valving and other measures such that hydrants have water over some period of time.	0.5	12
High	Immediately acquires situational awareness (eg., via SCADA), identifies and can isolate EFWS damage and compensate via valving and other measures such that hydrants have water.	0.75	6

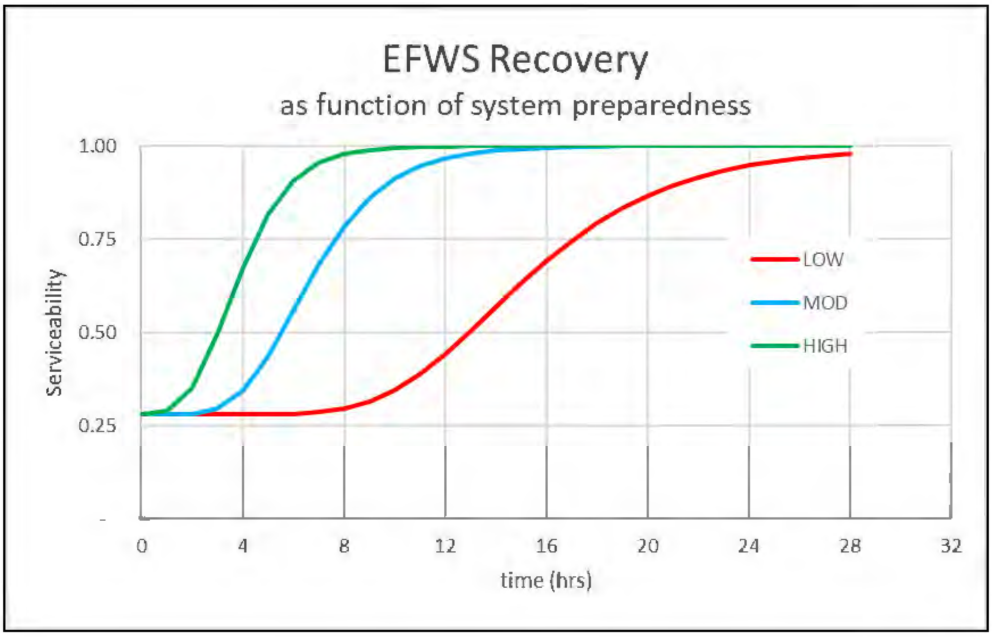


Figure 83 System recovery for Lower Zone of EFWS under three scenarios of system serviceability

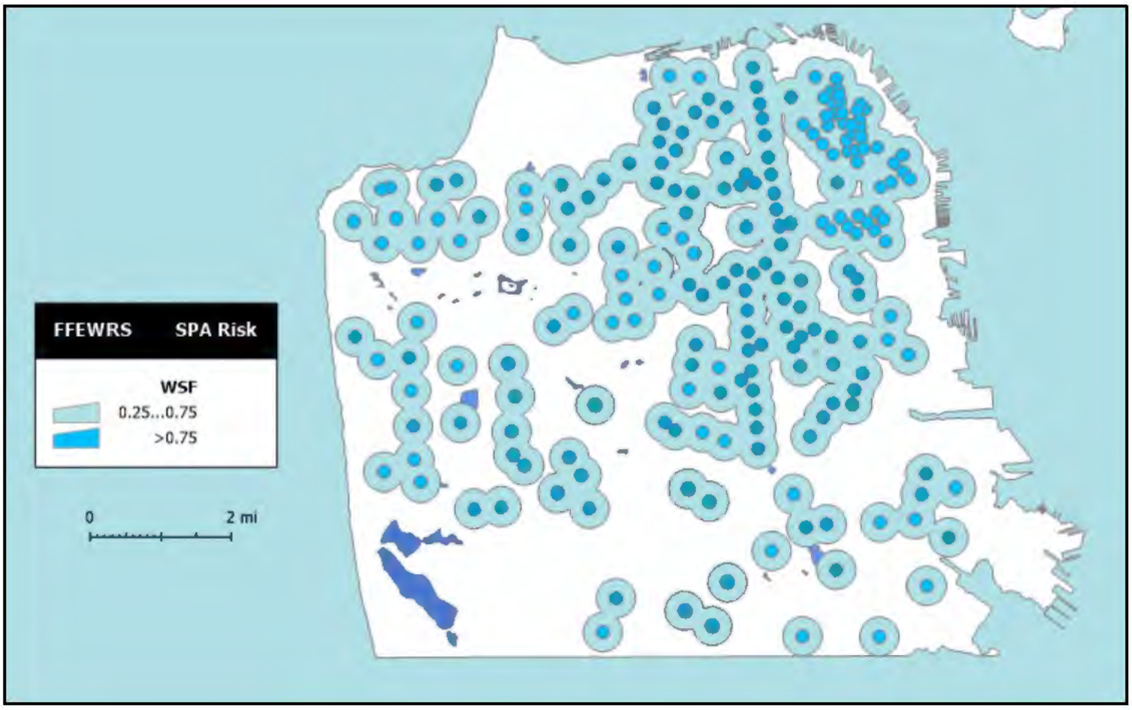


Figure 84 Cisterns WSF

Figure 85 Alternative Water Supplies' WSF

A similar but somewhat less complex process is used to determine $WSF_{cistern}$ and WSF_{AWS} given distance from the fireground to the water source, see Figure 84 and Figure 85. The aggregate pattern of WSF for each city block is shown in Figure 86, given the Phase 3 buildout.

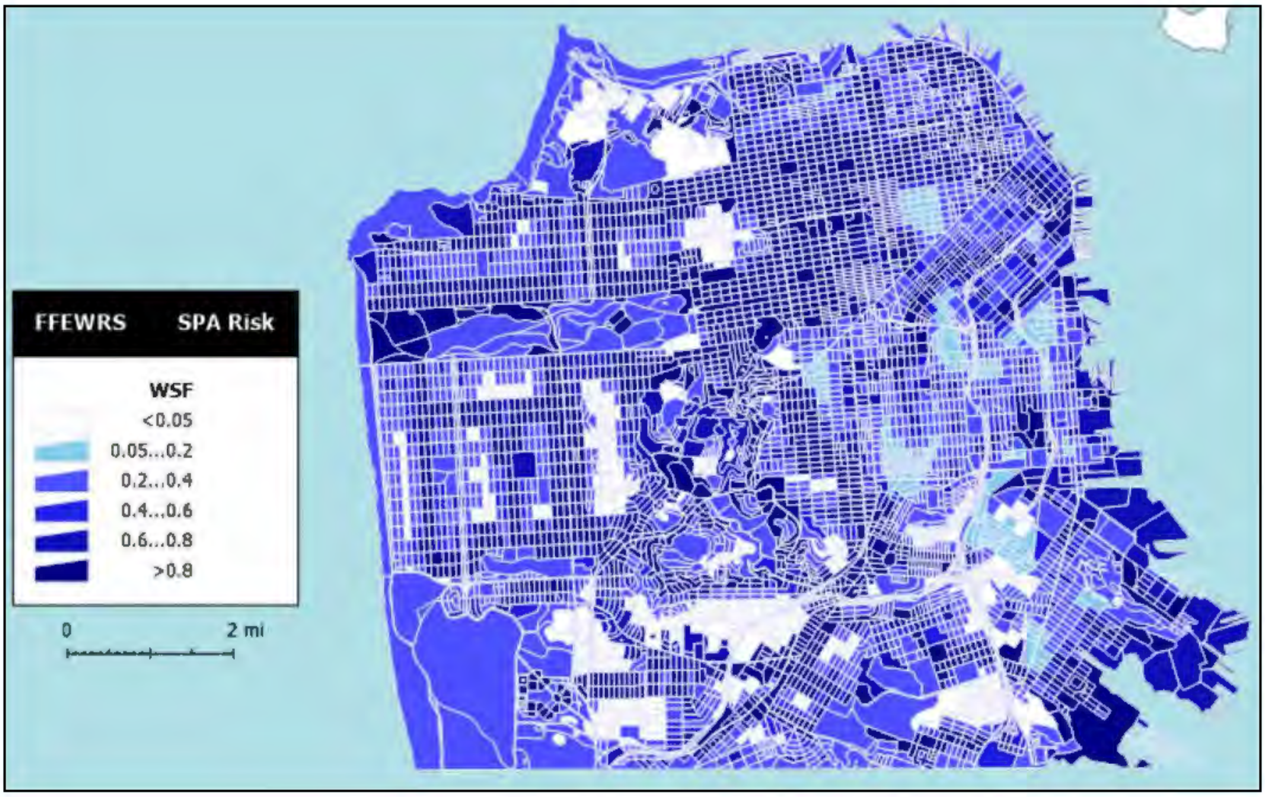


Figure 86 Water Supply Factor (WSF) given EFWS Phase 3 buildout

4.2.5 Fire Spread

The analysis assumes all fire service resources will initially focus on firefighting, leaving search and rescue, hazmat response and other emergencies until fires are brought under control. The initial ignitions will not all develop into large fires. Nevertheless, the normal structural fire response time will hardly be met. Delayed response, due primarily to failure of the 911 system, will result in many of the fires on arrival having grown such that a multi-engine capacity is needed. That is, an unfought ignition can grow into a room-sized fire within several minutes, and a fully involved single family structural fire within several more. To protect neighboring buildings ("exposures") typically two or more engine companies are needed. If only one company is available, it is possible that it might be able to protect two exposures (using monitor and a hand line, with civilian assistance), but sometimes unlikely. In fire following earthquake modeling, such fires, where the fire has grown exceeding one engine company's capabilities, are termed 'large fires'. The spread of these fires is a function of building materials and density, windspeed and firefighting efforts. Within city blocks, unfought fires can spread rapidly – experience of urban fire spread in the absence of firefighting in modern urban regions is limited although some data is available from wildland urban interface (WUI) fires and other events. Spread from block-to-block – that is, across streets and other fuel breaks, can easily occur in the absence of firefighting, Figure 87.

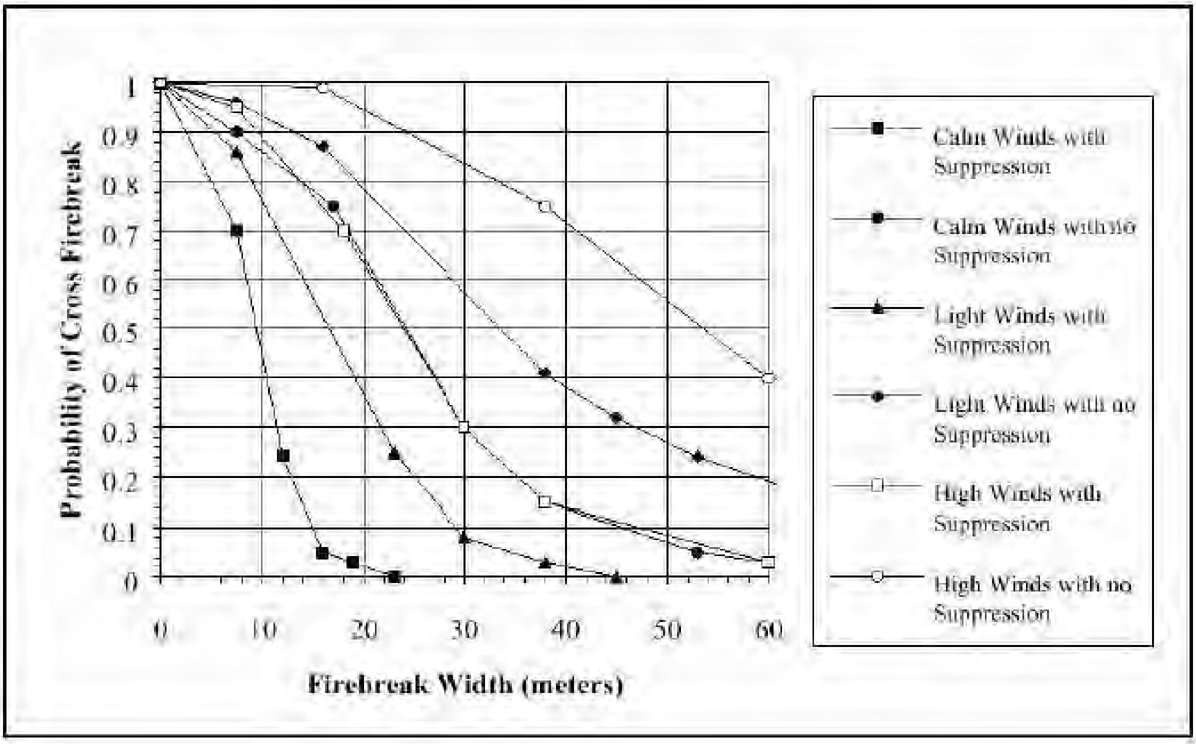


Figure 87 Probability of crossing firebreak (Scawthorn 1987; TCLEE 2005)

4.2.6 Firefighting and suppression

Modeling of post-earthquake firefighting and suppression differs somewhat from ordinary firefighting in that minimization of property damage via aggressive interior attack, the firefighting tactic for ordinary small to medium fires, is no longer the preferred tactic. Rather, while this remains the tactic for small fires (i.e., within one moderately sized room), the post-earthquake tactic is more defensive, seeking to contain and suppress the fire with as little commitment of resources as possible. Thus, the model uses algorithms from ordinary firefighting for small to medium sized fires (e.g., within one building (Benfer and Scheffey. 2015; Davis 2000; Grimwood and Barnett. 2005; Hadjisophocleous and Richardson 2005; Särdqvist 1998). For larger fires, perimeter defense becomes necessary and is employed to the capacity of available fire engines at the fireground. If this capacity is less than required for full containment, the fire grows, albeit at a slower rate. As and if more engines arrive, capacity becomes sufficient for full containment, and fire growth ceases. Water use continues, with no effort to conserve water but rather to contain and suppress the fire. When the fire has been fully contained and the fuel largely exhausted, some number of fire engines are required to remain for mop-up, to minimize the possibility of a rekindle. All during this period, water is still required. Water flow is tracked and is the primary measure of water usage for this report. Integration of water flow over the duration of the fire provides an estimate of total water required.

4.2.7 Required Water

Measurement of firefighting water for purposes of this study is more complex than for more ordinary fires, since the goal of this study is to estimate the water flow rate required at any point of time, rather than the flow rate actually applied. Thus is a subtle but elusive point that is best illustrated by example:

a) Consider a single family dwelling in a relatively densely built city block of similar dwellings. Think of the Richmond, Western Addition, Mission and similar districts in San Francisco.

b) Consider the earthquake occurs, and a lamp tips over and the hot bulb lands on and ignites the fabric covering a sofa. At this point, the amount of water required to suppress the ignition is miniscule – one might suppress the ignition by beating it with a magazine or use a cookpot of water.

c) However, the ignition hasn't yet been discovered, and grows. As can be seen in many demonstrations, the flames will rapidly spread, first across the fabric, then to the upholstery. Within 30 seconds, the fire cannot be beat out, but a gallon or two of water might suffice.

d) By 60 seconds, the fire has doubled in size and several gallons are required (think – where and how would you get several gallons of water to the living room, within a few tens of seconds? Without a garden hose, you probably couldn't).

e) By two minutes, the fire has again doubled in size and several tens of gallons of water are probably required.

f) By minute three, the fire has flashed over. Anyone in the room would now be badly if not fatally burned. Before this point, the amount of water and skill has passed beyond the capacity anyone but trained firefighters. With adequate water, trained firefighters contain the fire within another 45 seconds.

The above process is illustrated in Figure 88. The point is, at the 30th second, only a gallon or two of water is required. Because it hasn't been applied, within another 90 seconds, tens of gallons of water are required, and so on. Thus, **the amount of water required at any point in time is a function of the amount of water previously applied**. That is, the amount of water required at any point in time is a function of the fire department response, and the performance of the water network (or other sources) to supply the firefighters.

Figure 88 Flashover demonstration
Source: Oakridge TN FD, https://www.youtube.com/watch?v=BtMmymOxdjc)

Thus, the amount of water at any point in time can be measured according to four categories:

- ***Actual***, being the water flow actually applied by firefighters, according to actual practice in other fires. In the above example, at minute 2, this was zero – no water had been applied.

- ***Available***, being the maximum water flow that could be applied by all fire engines on-scene. In the above example, at minute 2, this was zero – firefighters hadn't yet arrived. At minute 3:45, with a fire engine on scene, this flow is 1500 gpm, the maximum capacity of the fire engine (which is far greater than what is needed to suppress this fire).
- ***Required***, being the water flow that is required to suppress the fire at that moment, considering previous suppression activities. At minute 2, this was several tens of gallons of water. At minute 3:35, this is one handline, or a flow of 250 gpm.
- ***Theoretical***, being the water flow required for full suppression and assuming there has been no prior suppression. At minute 3:45, this is the same as previously – that is, 250 gpm. At minute 5, if the firefighters hadn't arrived, this would now probably be 500 or more gpm.

Typically, Actual water flow will be less than or equal to Required, which may be more or less than Available, which will be less than Theoretical. That is Actual ≤ Required and/or Available < Theoretical. See Figure 89 and Figure 90 for illustration of these categories. Of these four categories, Actual and Required Water are the most realistic measures of the water the EFWS needs to provide, and Required Water has been selected as the most relevant for this project's purposes. All results will be in terms of Required Water.

Figure 89 Example fire for purposes of defining the four categories of water usage – example here is for a typical block in the Richmond, where one engine is available, and five buildings are fully involved (this size fire would normally be 3rd or 4th alarm fire, requiring the response of at least four to six engines, two trucks and other apparatus and senior officers).

Figure 90 Four categories of water usage: (top left) Actual water, being the water used by available firefighters; (top right) Available water, being the maximum flow by available engines (typ. a master stream); (lower left) Required water, being the total flow required to control the fire, and (lower right) "Theoretical" water, being the total flow at a point in time required to control the fire, if no firefighting has previously occurred (in this last case, the fire will have grown larger than the previous cases).

4.3 Monte Carlo simulation

The beginning of this chapter explained that the modeling of ignition, growth and spread of fires, and firefighting to suppress those fires, is performed within a Monte Carlo simulation framework. Therefore, for one trial, the simulation parameters or "case" are established. These consisted of deciding:

1. What scenario to consider (Mw 7.9 on the San Andreas fault, or Mw 7 on the Hayward).
2. What Phase was the EFWS in – Phase (0) meaning the current stage of buildout, or a later stage? Determining the Phase also determined future growth – Phase 0 corresponded to the year 2020, Phase 1 to 2030, Phase 2 to 2040 and Phase 3 to 2050, solely to determine future growth – there was no intention to imply that this was the schedule for EFWS buildout. Hopefully, the EFWS expansion will occur sooner than these dates.
3. Was the analysis to consider damage to the EFWS, or hypothetically to assume no damage at all?

4. Were the sysEff and sysImpr variables discussed above Low, Moderate or High?
5. Was SFFD its current size – that is, 44 engines on duty – or by say 2050 had SFFD added more engines commensurate with the City's growth?
6. Was the City's growth factored into the analysis? (in all Phase 1-3 cases, it was).

Not all possible combinations of the above parameters were considered – some of them were unrealistic and were eliminated by inspection. In total, there were 91 Cases that might be considered, which are listed in Table 1 above.

Having determined the simulation parameters, each trial of the Monte Carlo consisted of the following process:

1. Select an arbitrary day, hour and minute of the year. Based on this, select temperature, windspeed and direction, precipitation and relative humidity from the weather database.
2. Determine the scenario ground motion – there were 100 simulations of these to choose from, each calculated considering spatial correlation.
3. At time step 1, for the TFA of each block for the Phase under consideration and taking time of day into account, estimate the frequency of ignition considering randomness in the ignition equation. Comparing a random number to the frequency, determine if one or more ignitions have occurred in that block
4. Continue stepping time (10 minute time steps were employed) until that fire is discovered and reported. At the time of report, find the closest available engine.
5. Determine the time of arrival of that engine at the fireground, and the size of the fire at that time.
6. Taking into account WSFs for the EFWS, cisterns and Alternative Water Supplies, determine the probability of water being available. Compare this with a random number to determine if water is actually available.
7. If water is not available, on that engine remains on scene, for a standard amount of time, to assure life safety (that is, evacuate occupants from the burning and nearby buildings and attend to other needs as required).
8. If water is available, start application. If the capacity of the engine is sufficient to contain the fire, the engine remains on scene for a standard amount of time. Size of the fire at each time step is calculated taking into account building materials of construction, occupancy, building spacing, number of floors and other features, and weather conditions.
9. If the fire exceeds the capacity of the initial engine, the crew partially contains the fire, which grows at a slower rate. More engines are called for. As and if they arrive, the fire is contained, or not. In the latter case, the fire continues to grow.
10. As the fire grows, track its growth considering on-scene engines and water availability. Determine if and when the fire spreads to neighboring blocks, considering windspeed and direction.
11. Continue this process to the end of the simulation (hour 25), tracking each fire as to if and when contained, burnt out due to lack of fuel (i.e., didn't cross to a neighboring

block, or that block was vacant of fuel) or was still burning at the end. During the entire process, track Required Water at each fire for each time step.

The above is one trial of the Monte Carlo simulation and is illustrated in Figure 91, which should be read from the top (ie, Ground Shaking) and then counter clockwise following the arrows, until the process arrives at the top again, which has been one time step. Repeat for each of 150 ten minute time steps.

For each case, 100 trials were run, with each trial selecting a day and time (and weather) in Step 1, a different scenario ground motion in Step 2, and so on.

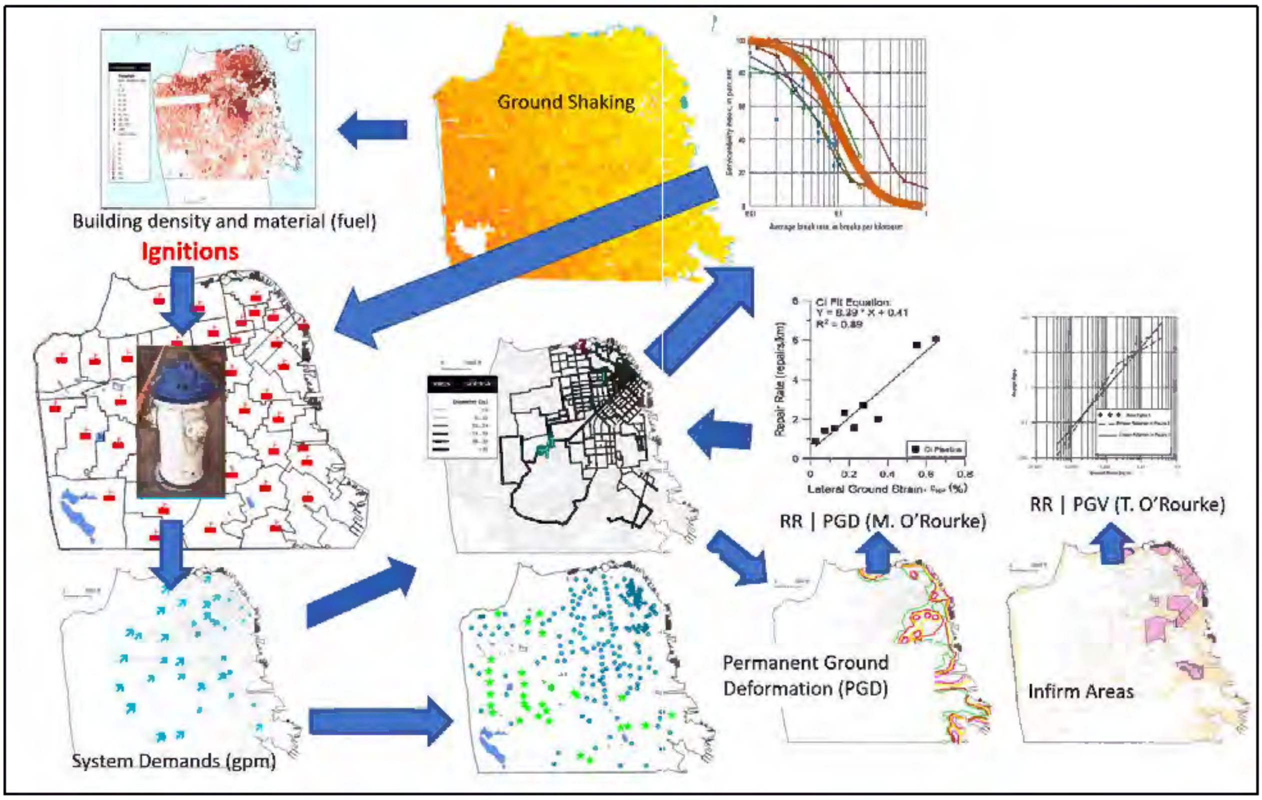


Figure 91 Process for one trial of the Monte Carlo simulation employed in this study. Process begins at the top (ie, Ground Shaking) and then proceeds counter clockwise following the arrows, until the process arrives at the top again, which has been one time step.

5 DETAILED RESULTS

Detailed numerical and graphical results have been transmitted to SFPUC in the form of 46,930 electronic files totaling 122 mb. Results of the analysis of 21 Cases for current and future variations in EFWS and SFFD improvements shows that effective firefighting under current conditions is estimated to require flows of about 140,000 gpm (median, 75th percentile is 200,000+ gpm) after the first few hours, equivalent to a total volume of about 200+ million gallons in the first 24 hours after an earthquake. Results for various Cases show that future water requirements can remain about the same, or be much larger, depending on the improvements made to the EFWS and SFFD.

5.1 Introduction

This section reviews results in three aspects:

- Analysis cases
- File structure for results
- Examination of Case 1 results
- Summary results for selected cases

5.2 Analysis Cases

The Monte Carlo Simulation was applied to a number of cases eacj denoted

Phx v1v2v3v4v5

where

Phx refers to Phases 0 (the existing EFWS high-pressure network) and Phases 1, 2 and 3 refer to succeeding stages of EFWS buildout.

v1 denotes whether and how **system damage** is considered – that is, v1 = D denotes pipe breaks and leaks are included in the analysis, v1 = N considers the system to be undamaged, and v1 = P triggers a probabilistic weighting of damage occurrence.

v2 denotes whether and how **system operational efficiency** is considered – that is, v2 = L denotes a slow operational response to system damage, with some time required to assess damage and respond with valve closures and other measures, v1 = M denotes a moderate operational response, v3 = H denotes good situational awareness (e.g., via a high-resolution SCADA) and rapid response (e.g., via a dense network of automatic or remotely operable motor operated valves, MOVs), and v3=E denotes efficient system operations, significantly exceeding v3=H such that the system is fully functional almost without interruption.

v3 denotes whether **system improvements** have been implemented – that is, v3 = Y denotes system improvements for that Phase have been implemented, while v31 = N denotes no improvements.

v4 denotes whether **SFFD resources have been increased** – that is, v4 = C denotes the current number of SFFD fire engines (initially 43, as described above) are what is available for that Phase, while v4 = A considers SFFD has been increased in size with additional engines and hose tenders commensurate with the population growth for that Phase.

v5 denotes whether **City growth** is considered – that is, v5 = B the current population and building inventory, while v5 = F denotes population and growth projections for 2030 (Phase 1), 2040 (Phase 2) and 2050 (Phase 3) were employed. Use of these specific years is not meant to imply that EFWS expansion will occur by that year.

Thus, for example, Ph0 DLNCB denotes an analysis for Ph0 (i.e., the current EFWS high-pressure network) considering damage to the system, Low system operational response to that damage, No system improvements, Current SFFD resources and current (i.e., 2020) City growth, the latter three variables being consistent with Ph0. Another example: Ph3 PHNAF denotes Ph3 buildout of the EFWS, High system operational response to that damage, No system improvements, a larger SFFD with more resources and Future (i.e., 2050) City growth. In all, there are 91 feasible combinations of Phases and v1 to v5, as shown in Table 10.

Table 10 Case List

Case	Ph	sysDmg	sysEff	sysImpr	SFFD	Growth
1	0	D	L	N	C	B
2	0	D	M	N	C	B
3	0	D	H	N	C	B
4	0	N	E	N	C	B
5	0	P	L	N	C	B
6	0	P	M	N	C	B
7	0	P	H	N	C	B
8	1	D	L	Y	C	F
9	1	D	L	Y	A	F
10	1	D	L	N	C	F
11	1	D	L	N	A	F
12	1	D	M	Y	C	F
13	1	D	M	Y	A	F
14	1	D	M	N	C	F
15	1	D	M	N	A	F
16	1	D	H	Y	C	F
17	1	D	H	Y	A	F
18	1	D	H	N	C	F
19	1	D	H	N	A	F
20	1	N	E	Y	C	F
21	1	N	E	Y	A	F
22	1	N	E	N	C	F
23	1	N	E	N	A	F
24	1	P	L	Y	C	F
25	1	P	L	Y	A	F
26	1	P	L	N	C	F
27	1	P	L	N	A	F
28	1	P	M	Y	C	F
29	1	P	M	Y	A	F
30	1	P	M	N	C	F
31	1	P	M	N	A	F
32	1	P	H	Y	C	F
33	1	P	H	Y	A	F
34	1	P	H	N	C	F
35	1	P	H	N	A	F
36	2	D	L	Y	C	F
37	2	D	L	Y	A	F
38	2	D	L	N	C	F
39	2	D	L	N	A	F
40	2	D	M	Y	C	F
41	2	D	M	Y	A	F
42	2	D	M	N	C	F
43	2	D	M	N	A	F
44	2	D	H	Y	C	F
45	2	D	H	Y	A	F
46	2	D	H	N	C	F
47	2	D	H	N	A	F
48	2	N	E	Y	C	F
49	2	N	E	Y	A	F
50	2	N	E	N	C	F
51	2	N	E	N	A	F
52	2	P	L	Y	C	F
53	2	P	L	Y	A	F
54	2	P	L	N	C	F
55	2	P	L	N	A	F
56	2	P	M	Y	C	F
57	2	P	M	Y	A	F
58	2	P	M	N	C	F
59	2	P	M	N	A	F
60	2	P	H	Y	C	F
61	2	P	H	Y	A	F
62	2	P	H	N	C	F
63	2	P	H	N	A	F
64	3	D	L	Y	C	F
65	3	D	L	Y	A	F
66	3	D	L	N	C	F
67	3	D	L	N	A	F
68	3	D	M	Y	C	F
69	3	D	M	Y	A	F
70	3	D	M	N	C	F
71	3	D	M	N	A	F
72	3	D	H	Y	C	F
73	3	D	H	Y	A	F
74	3	D	H	N	C	F
75	3	D	H	N	A	F
76	3	N	E	Y	C	F
77	3	N	E	Y	A	F
78	3	N	E	N	C	F

Case	Ph	sysDmg	sysEff	sysImpr	SFFD	Growth
79	3	N	E	N	A	F
80	3	P	L	Y	C	F
81	3	P	L	Y	A	F
82	3	P	L	N	C	F
83	3	P	L	N	A	F
84	3	P	M	Y	C	F
85	3	P	M	Y	A	F
86	3	P	M	N	C	F
87	3	P	M	N	A	F
88	3	P	H	Y	C	F
89	3	P	H	Y	A	F
90	3	P	H	N	C	F
91	3	P	H	N	A	F

In consultation with SFPUC and AECOM it was determined that not all 91 possible cases need be analyzed, so that 21 cases were analyzed, consisting of Cases:

1) 1 Ph0 DLNCB
2) 2 Ph0 DMNCB
3) 3 Ph0 DHNCB
4) 4 Ph0 NENCB
5) 20 Ph1 NEYCF
6) 22 Ph1 NENCF
7) 48 Ph2 NEYCF
8) 50 Ph2 NENCF
9) 64 Ph3 DLYCF
10) 65 Ph3 DLYAF
11) 66 Ph3 DLNCF
12) 67 Ph3 DLNAF
13) 68 Ph3 DMYCF
14) 69 Ph3 DMYAF
15) 72 Ph3 DHYCF
16) 73 Ph3 DHYAF
17) 74 Ph3 DHNCF
18) 75 Ph3 DHNAF
19) 76 Ph3 NEYCF
20) 77 Ph3 NEYAF
21) 78 Ph3 NENCF

It is anticipated a number of additional cases will be analyzed as the EFWS design proceeds.

These 21 cases were run for both the San Andreas Mw 7.9 and Hayward Mw 7 scenario events, so in total 42 cases were run.

5.3 File structure

Data files transmitting complete results for all analyzed cases have been posted to the SFPUC project SharePoint archive folder "FFEWRS RESULTS" in a zip file containing 46,930 electronic files totaling 122 mb. The zip file is named

"FFEWRS output 28 May 2021.zip"

and is highlighted in Figure 92.

Figure 92 Image of zip file uploaded to Sharepoint archive

The zip file contains 42 folders named:

H7.05 Case 1 Ph0 DLNCB totSim 100 ts=10 2021-05-26 18-02
H7.05 Case 2 Ph0 DMNCB totSim 100 ts=10 2021-05-26 18-13
H7.05 Case 3 Ph0 DHNCB totSim 100 ts=10 2021-05-26 18-23
H7.05 Case 4 Ph0 NENCB totSim 100 ts=10 2021-05-26 18-34
H7.05 Case 20 Ph1 NEYCF totSim 100 ts=10 2021-05-26 18-45
H7.05 Case 22 Ph1 NENCF totSim 100 ts=10 2021-05-26 18-58
H7.05 Case 48 Ph2 NEYCF totSim 100 ts=10 2021-05-26 19-11
H7.05 Case 50 Ph2 NENCF totSim 100 ts=10 2021-05-26 19-26
H7.05 Case 64 Ph3 DLYCF totSim 100 ts=10 2021-05-26 19-45
H7.05 Case 65 Ph3 DLYAF totSim 100 ts=10 2021-05-26 20-12
H7.05 Case 66 Ph3 DLNCF totSim 100 ts=10 2021-05-26 20-42
H7.05 Case 67 Ph3 DLNAF totSim 100 ts=10 2021-05-26 21-02
H7.05 Case 68 Ph3 DMYCF totSim 100 ts=10 2021-05-26 21-18
H7.05 Case 69 Ph3 DMYAF totSim 100 ts=10 2021-05-26 21-33
H7.05 Case 72 Ph3 DHYCF totSim 100 ts=10 2021-05-26 21-47
H7.05 Case 73 Ph3 DHYAF totSim 100 ts=10 2021-05-26 22-03
H7.05 Case 74 Ph3 DHNCF totSim 100 ts=10 2021-05-26 22-20
H7.05 Case 75 Ph3 DHNAF totSim 100 ts=10 2021-05-26 22-35
H7.05 Case 76 Ph3 NEYCF totSim 100 ts=10 2021-05-26 22-51
H7.05 Case 77 Ph3 NEYAF totSim 100 ts=10 2021-05-26 23-06
H7.05 Case 78 Ph3 NENCF totSim 100 ts=10 2021-05-26 23-21
SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-05-14 22-23
SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-05-15 13-45
SA7.9 Case 1 Ph0 DLNCB totSim 100 ts=10 2021-05-17 17-06
SA7.9 Case 1 Ph0 DLNCB totSim 100 ts=10 2021-05-17 20-36
SA7.9 Case 2 Ph0 DMNCB totSim 100 ts=10 2021-05-17 21-15
SA7.9 Case 3 Ph0 DHNCB totSim 100 ts=10 2021-05-17 21-50
SA7.9 Case 4 Ph0 NENCB totSim 100 ts=10 2021-05-17 22-23
SA7.9 Case 20 Ph1 NEYCF totSim 100 ts=10 2021-05-17 22-54
SA7.9 Case 22 Ph1 NENCF totSim 100 ts=10 2021-05-17 23-28
SA7.9 Case 48 Ph2 NEYCF totSim 100 ts=10 2021-05-18 00-03
SA7.9 Case 50 Ph2 NENCF totSim 100 ts=10 2021-05-18 00-41
SA7.9 Case 64 Ph3 DLYCF totSim 100 ts=10 2021-05-18 01-20
SA7.9 Case 65 Ph3 DLYAF totSim 50 ts=10 2021-05-17 16-38
SA7.9 Case 65 Ph3 DLYAF totSim 100 ts=10 2021-05-18 02-05
SA7.9 Case 66 Ph3 DLNCF totSim 100 ts=10 2021-05-18 02-47
SA7.9 Case 67 Ph3 DLNAF totSim 100 ts=10 2021-05-18 03-33
SA7.9 Case 68 Ph3 DMYCF totSim 100 ts=10 2021-05-18 04-15
SA7.9 Case 69 Ph3 DMYAF totSim 100 ts=10 2021-05-18 04-59
SA7.9 Case 72 Ph3 DHYCF totSim 100 ts=10 2021-05-18 05-41
SA7.9 Case 73 Ph3 DHYAF totSim 100 ts=10 2021-05-18 06-23
SA7.9 Case 74 Ph3 DHNCF totSim 100 ts=10 2021-05-18 07-05
SA7.9 Case 75 Ph3 DHNAF totSim 100 ts=10 2021-05-18 07-47
SA7.9 Case 76 Ph3 NEYCF totSim 100 ts=10 2021-05-18 08-28
SA7.9 Case 77 Ph3 NEYAF totSim 100 ts=10 2021-05-18 09-10
SA7.9 Case 78 Ph3 NENCF totSim 100 ts=10 2021-05-18 09-54

For example, a folder name denotes the analysis is for

- the San Andreas Mw 7.9 event

- is Case 1 with
- identifier code "Ph0 DLNCB" as explained previously
- has a total of 100 simulations for the Case
- uses a time step "ts" of 10 minutes and
- is timestamped with date and time shown. The date and time are important as the unique identifier of a specific analysis.

Each folder contains 100 subfolders, one for each simulation, and also contains selected summary data files as shown in Figure 93 (the grayed out subfolder can be ignored for now – it is created in all cases but only optionally contains additional data, that option not exercised at this time).

Figure 93 Example image of Case output folder structure

Case summary files

Summary files for the 100[17] simulations are contained in the main folder and are shown in Figure 94. File "ALL Summary Table TotSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv" is a comma separated variable ("csv") file that summarizes all simulations for this Case, a portion of which is shown in Figure 95 (and explained further in Figure 96 for Simulation (or

[17] The example figures are for an earlier run of 50 simulations, rather than 100 as delivered.

"trial") 1 of Case 1). Other files detail the actual, available, required and "theoretical" water used for each timestep, the timeline of area burned, the blocks that had fire, the timeline of burnt total floor area (TFA), the timeline of engine deployment (i.e., at each time step, which fire each engine is assigned to), the fire timeline (i.e., growth of each fire), a summary of ignitions (time, block), and which fires are due to firespread from another block ("XedTable").

Act Cum Water UsedSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Act Water FlowSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
ALL Summary Table TotSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.xlsx
allActWater SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv
allIgnsSortbyTime TOTSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.xlsx
allReqWater SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv
Avail Cum Water UsedSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Avail Water FlowSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Req Cum WaterSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Req Water FlowSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
summaryCaseTable SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv
TFA burned (sq ft)SA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Theoret Cum Water UsedSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
Theoret. Water FlowSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.jpg
totWaterUsePerBlkSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv

Figure 94 Example summary files for one Case

	A	B	C	D	E	F	G	H	I	J	K	L
1	No	gmNo	windx	month	day	hour	tempF	windspeed_mph	winddir	precip_in	totNoIgns	availWater
2	1	33	20390	1	29	2	56	2.2	270	0	85	900
3	2	4	36079	11	12	19	67	4.5	80	0	90	910
4	3	43	27395	11	16	23	62	13.4	290	0	111	1550
5	4	1	4252	3	27	16	49.3	4.5	300	0	96	1080
6	5	97	39029	3	15	17	57.8	4.5	330	0	91	980
7	6	95	8290	9	11	22	74.4	4.5	241	0	70	720
8	7	19	41641	7	2	13	59	2.2	244	0	93	960
9	8	98	4952	4	25	20	60.5	13.4	330	0	90	1200
10	9	25	28176	12	19	12	48.5	2.2	60	0.1	77	780
11	10	22	11726	2	2	2	50.3	2.2	179	0	96	1050
12	11	42	24810	8	1	6	63.4	6.7	260	0	66	750
13	12	27	21062	2	26	2	57.1	4.5	280	0	85	1020
47	46	2	10813	12	26	1	59.3	2.2	303	0	86	860
48	47	17	28363	12	27	7	36.3	2.2	102	0	94	980
49	48	2	3030	2	4	18	52.4	11.2	290	0	90	1400
50	49	50	39764	4	15	8	50.3	4.5	100	0	85	970
51	50	70	44451	10	27	15	54.1	2.2	175	0	81	820
52												

M	N	O	P	Q	R	S	T
initialSFED	initialAreaFireSQFT	initialEngsReqd	totNoBlksInvolved	totBurntAreaSF	totActualWaterGals	totAvailWaterGals	totTheoretWaterGals
425.1	637036	42	91	13185858.67	15339900	155280000	72464780
765.8	1147941	70.1	98	17207166.91	29922860	157410000	153582300
3571.8	5357043	231.9	161	21690148.3	81681100	244830000	398040580
398.5	596983	65.7	109	15327377.24	20240670	183075000	95343400
338.3	505950	51.3	99	13608369.61	22189600	171705000	107508040
71.6	107574	29.4	74	11085721	11384280	123750000	53682180
180.1	269104	38.5	98	14779862.33	7463890	157065000	33994670
738.2	1105646	158.5	127	15600252.28	54527590	191775000	263243320
186.8	279382	32.8	80	11524189.33	13143410	136140000	63898300
228.5	341765	50.6	112	17116675.22	24493340	181920000	133170980
53.7	80217	33.2	79	16449539	1265460	118965000	4073970
544.1	815892	80	104	14759599.82	18331810	176550000	87265990
433.6	650628	54	90	12952281.64	26116960	153075000	128379030
521.6	781882	58.2	89	13827273.67	23637460	168135000	115070810
1649.1	2472803	181.1	144	19052293.85	58871910	222435000	282845200
672	1007343	74.5	102	14948589.53	41420270	174180000	202123580
261.7	392355	39.4	86	15139457.96	23810570	153495000	117598130

Figure 95 Example "ALL Summary Table TotSA7.9 Case 1 Ph0 DLNCB totSim 50 ts=10 2021-04-18 18-57.csv" file, Case 1 Trial 1

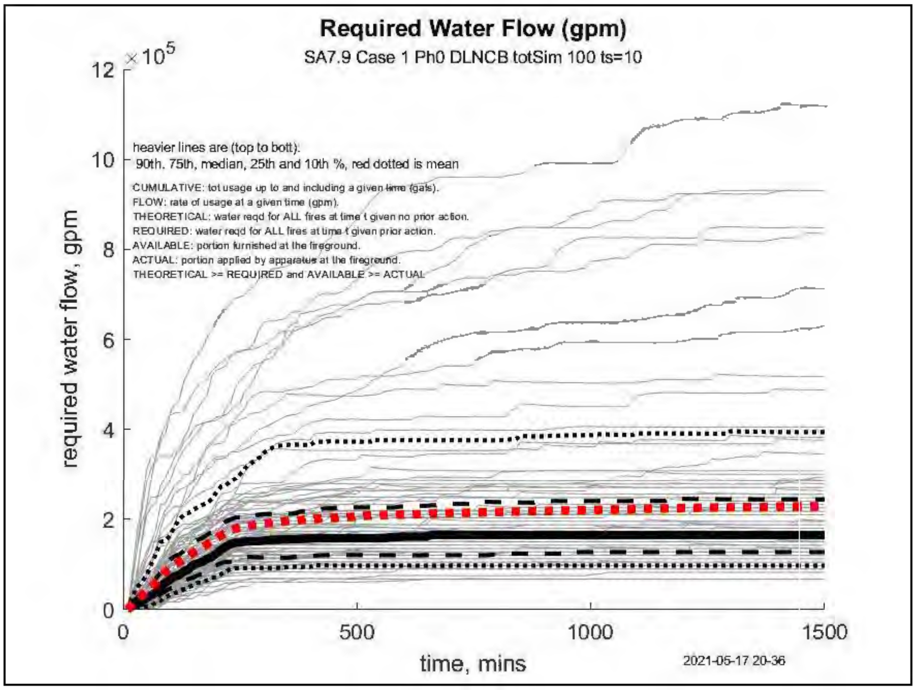
Col Name	explanation	value
No	Simulation no. 1 of 50 (i.e., 50 trials)	1
gmNo	ground motion ID used for this trial	33
wIndx	weather index (i.e., number of day)	20390
month	month for day corresp. to windx (January)	1
day	day of month	29
hour	hour of day (2 am)	2
tempF	temperature (F) at that time	56
windspeed_mph	windspeed (mph) at that time	2.2
winddir	direction of wind at that time (due West)	270
precip_in	precipitation at that time (inches)	0
totNoIgns	total no. original ignitions this trial	85
availWater	no. fires in this trial that had water available * time step	900
initialSFED	sum of single family equiv. dwellings (SFED) on fire at first arrival, all igns.	425.1
initialAreaFireSQFT	sum of floor area (sq. ft.) burning at first arrival, all igns.	637036
initialEngsReqd	initial no. of engines required	42
totNoBlksInvolved	total no. of blocks involved, including fire spread	91
totBurntAreaSF	tot. burnt area at 25th hour (sq. ft)	13185858.67
totActualWaterGals	total actual water used (gals) by 25th hour (gallons)	15339900
totAvailWaterGals	total available water (i.e., pumping capacity if full used) by 25th hours (gallons)	155280000
totTheoretWaterGals	tot "theoretical" water needed at hour 25 (gallons)	72464780

Figure 96 Explanation of line 1 of data in Figure 95 Case 1 Trial 1

There are a number of summary plots in jpg files.

File “Req Water FlowSA7.9 Case 1 Ph0 DLNCB totSim 100 ts=10 2021-05-17 20-36.jpg” is a jpg file of a plot of the Required water used for all 100 simulations for this Case, vs. time. This is shown as the upper plot in Figure 97: Required water flows (gpm), with the lower plot being cumulative Required water (gallons). As noted in the legend, individual simulations are shown as thin gray lines, with the median of the 50 simulations shown as a heavy black line, the 25th and 75th percentiles as heavy dashed lines, and the 10th and 90th percentiles shown as heavy dotted lines. The mean of the 50 simulations is shown as heavy red dashed line. The legend also provides a summary description of Actual vs. Available vs. Required vs. Theoretical water usage, as was described above. As can be seen in the figure, at 1500 minutes (ie, 25th hour) the median (i.e., 50th %) Required flow for the 100 simulations of this Case is 75,000 gpm, the mean (i.e., arithmetic average) Required flow is 88,000 gpm, the 75th % Required flow is 105,000 gpm and the 90th % Required from is 172,500 gpm.

The cumulative Required Water is also shown in Figure 97, where the median total amount of water required by the 25th hour is seen to be about 95 million gallons, the mean Required water about 125 million galls and the 75th percentile about 148 million gallons. The equivalent number of fire engines required to flow 148 million gallons of water is about 67 engines – that is, about 25% more engines than SFFD can currently deploy in a timely manner (this includes reserves). If as currently planned, a dozen or so more hose tenders are added to the roster, and with some mutual aid, the Required Water could be effectively applied. This is for current conditions and assets at risk (i.e., Phase 0). Table 2 summarizes Required Water (total usage in gallons, and flows in gpm) for selected time periods for the 9 analyzed cases. It can be seen that 24th hour Required water 75th percentile demands range from 140 to 220 million gallons, depending on the Case.



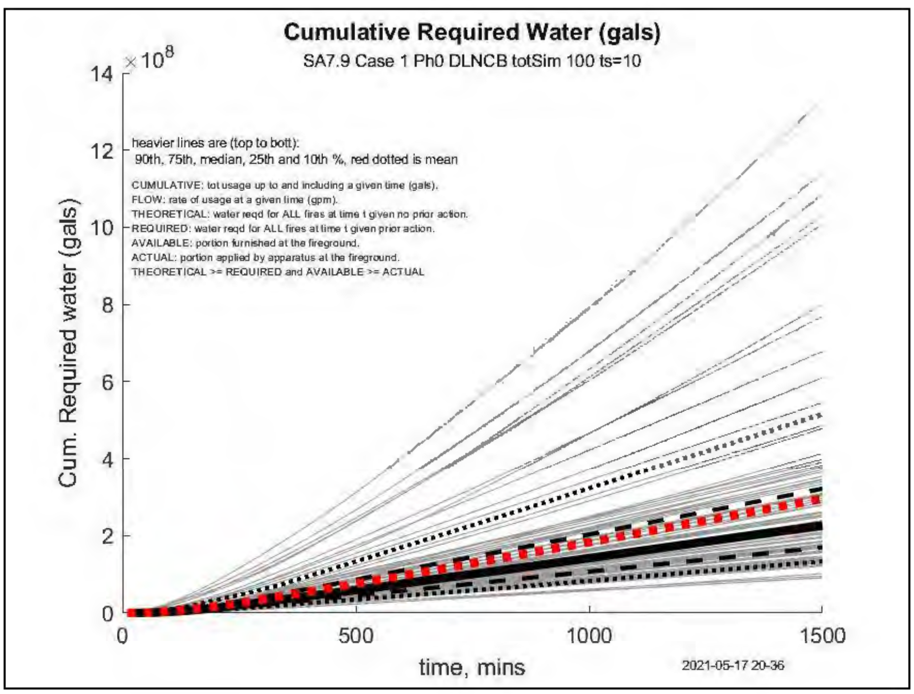


Figure 97 Plot of Required water usage for this Case (Case identification information shown at top with unique timestamp in lower left corner): (top) flows, gpm; (bottom) cumulative usage, gallons.

Example simulation results

Each subfolder (e.g., "Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57") contains the csv files shown Figure 98, each of which provide actual water, area burned etc for each time step

- actualWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- areaBurnedTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- availWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- blksInvolved Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- burntTFAtimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- engTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- fireTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- igns Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- reqWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- thWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv
- XedTable Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57.csv

Figure 98 One simulation example subfolder content

For example, the Required Water ("reqWater") timeline is shown in Figure 14 (note the view is split in four quadrants) and shows for each of 91 ignitions (the number of ignitions for this simulation – the number varies with each simulation; note that each row represents an ignition) the required water flow (gpm) at minute 0 (col A), minute 10 (col B) and so on to minute 1500 (col ET), each column being a 10 minute timestep. Total required water per fire in gallons is simply the summation of a row (times 10) and total water flow (gpm) at any 10 minute time step is simply the summation of that column.

	A	B	C	D	E	F	G	H	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET
1	0	181	147	125	107	92	79	67	0	0	0	0	0	0	0	0	0	0	0
2	0	269	215	181	155	133	114	98	0	0	0	0	0	0	0	0	0	0	0
3	66	50	42	36	31	26	23	19	0	0	0	0	0	0	0	0	0	0	0
4	82	61	51	43	37	32	27	23	0	0	0	0	0	0	0	0	0	0	0
5	87	67	56	48	41	35	30	26	0	0	0	0	0	0	0	0	0	0	0
6	0	102	83	70	60	51	44	38	0	0	0	0	0	0	0	0	0	0	0
7	39	31	26	22	19	16	14	12	0	0	0	0	0	0	0	0	0	0	0
8	0	343	246	203	173	148	128	110	0	0	0	0	0	0	0	0	0	0	0
9	53	371	309	264	227	195	167	142	0	0	0	0	0	0	0	0	0	0	0
10	120	86	71	60	52	45	38	33	0	0	0	0	0	0	0	0	0	0	0
11	86	62	51	43	37	32	27	23	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	13	10	8	5	3	1	0	0	0	0	0
84	0	0	0	0	0	0	0	0	12	10	8	6	4	2	1	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	132	106	90	77	66	57	48
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
91	0	0	0	0	0	0	0	0	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500

Figure 99 Example contents of file "reqWaterTimeline Sim = 1 SA7.9 totSim 50 ts=10 Ph0 no Pot sys EFWS Dmge SFFD Curr 2021-04-18 18-57" (note the view is split in four quadrants)

5.4 Required Water

The above sections have described in some detail the details of the electronic file deliverables of this project. This section presents summary tables of some of the results.

Table 11 presents summary results for the San Andreas scenario event, at hours 1, 2, 4, 8, 12 and 24 for the 21 Cases discussed above. The summary results are Required Water flow (gpm), total Required Water flow (gallons) and Burnt TFA (sq. ft). Three measures of these quantities are provided: median, mean and 75th percentile.

Table 12 presents comparable data, for the Hayward scenario event.

In each table, for each Case, headers identify the Case number, the scenario event (SA 7.9 or H7), the Phase, the Case code previously explained (e.g., DLNCB), the number of simulations (sim = 100), and the timestamp of the run.

This same data is presented in much greater detail in the electronic files, and also in graphical form such as Figure 97.

San Andreas Mw 7.9 scenario

Table 11 Selected Case results, Mw 7.9 San Andreas scenario

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	1	SA7.9	Ph0	DLNCB	sim = 100	2021-05-17 20-36			
1	1,391,215	2,200,707	2,398,095	37,925	60,101	68,534	6,073,395	6,558,901	7,746,627
2	5,450,310	7,838,924	9,104,115	85,073	112,493	129,626	10,013,565	9,816,052	11,322,081
4	20,567,835	26,226,905	30,591,395	148,343	181,792	203,760	13,722,122	14,042,751	15,013,476
8	57,747,605	73,483,358	83,810,745	158,355	205,114	226,475	16,188,562	16,771,795	17,941,779
12	97,126,680	124,073,438	140,085,875	165,258	214,280	234,132	17,721,483	18,218,647	19,345,646
24	217,945,215	284,066,060	309,417,000	165,059	228,439	243,896	18,805,777	19,494,772	20,138,189

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	2	SA7.9	Ph0	DMNCB	sim = 100	2021-05-17 21-15			
1	1,255,945	1,896,652	2,647,275	30,841	53,215	74,767	6,384,838	6,929,902	8,560,807
2	4,675,270	6,469,846	8,969,385	70,876	87,156	114,439	10,254,386	10,162,923	11,484,436
4	16,345,395	20,463,367	25,698,970	116,126	141,992	164,095	13,104,007	13,326,021	14,224,280
8	45,946,150	57,607,466	69,170,045	128,088	162,931	197,338	15,638,418	15,883,424	17,023,214
12	77,580,355	97,880,740	116,374,045	127,862	170,872	203,276	16,660,032	17,198,452	18,643,632
24	176,196,300	225,078,261	265,745,535	131,445	180,384	218,535	17,603,472	18,462,807	19,734,070

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	3	SA7.9	Ph0	DHNCB	sim = 100	2021-05-17 21-50			
1	1,137,315	1,866,674	2,305,065	35,644	53,877	63,928	6,180,604	6,873,323	8,784,098
2	4,736,810	6,348,172	7,098,815	70,604	84,456	101,050	10,215,474	9,883,545	11,015,106
4	16,017,340	19,048,431	22,532,790	113,099	127,981	153,976	12,919,952	12,834,924	13,737,418
8	44,944,890	52,508,526	62,958,075	118,837	148,174	184,056	14,746,539	15,362,821	16,713,232
12	73,886,420	89,192,294	108,299,705	120,467	155,730	188,025	16,223,247	16,779,169	17,985,514
24	161,506,565	205,388,588	245,721,935	120,072	166,243	195,212	17,014,129	17,952,085	18,886,069

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	4	SA7.9	Ph0	NENCB	sim = 100	2021-05-17 22-23			
1	989,065	1,726,091	1,751,555	29,964	47,639	52,221	6,125,272	6,832,634	8,552,232
2	4,110,440	5,737,384	6,456,865	60,978	76,128	89,719	10,133,817	9,991,565	11,256,234
4	12,927,880	17,249,632	20,050,455	98,274	116,963	133,421	12,647,680	12,636,931	13,673,695
8	37,488,420	48,410,831	55,955,625	105,660	139,427	158,226	14,354,011	15,177,212	16,237,165
12	62,652,855	83,122,634	94,711,645	105,338	149,046	159,105	16,161,046	16,588,637	17,411,674
24	140,612,055	194,052,835	222,871,470	112,510	159,258	184,002	16,857,818	17,850,175	18,150,123

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	20	SA7.9	Ph1	NEYCF	sim = 100	2021-05-17 22-54			
1	1,171,530	1,907,879	2,362,740	32,462	52,335	62,402	11,709,084	12,075,294	14,752,361
2	4,292,980	6,179,754	7,857,980	61,784	78,539	104,329	16,463,246	16,458,245	18,111,069
4	13,089,660	18,313,281	24,591,340	96,182	127,097	165,003	19,148,948	19,675,971	20,385,586
8	36,058,210	51,481,342	66,167,340	104,064	146,538	181,841	22,764,208	23,263,769	25,419,354
12	62,893,430	88,145,003	110,916,710	112,981	155,876	194,006	24,250,158	25,140,653	26,356,993
24	143,242,345	205,044,579	256,042,890	112,621	167,254	202,586	25,421,403	26,431,649	27,276,484

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	22	SA7.9	Ph1	NENCF	sim = 100	2021-05-17 23-28			
1	1,253,950	1,969,794	2,636,330	38,011	55,524	80,568	12,114,885	12,088,829	15,135,430
2	4,820,015	6,472,230	8,759,305	68,944	82,589	107,720	16,613,484	16,428,332	18,599,383
4	15,288,925	18,913,839	23,945,920	112,025	126,870	151,409	19,269,085	19,777,223	21,270,366
8	42,212,680	52,582,349	63,877,145	121,435	149,952	173,300	23,302,719	23,561,334	25,737,301
12	71,445,530	89,982,109	106,042,265	124,166	159,291	184,009	24,141,068	25,107,416	26,807,268
24	161,177,410	209,452,193	241,440,065	128,048	169,887	202,599	25,425,756	26,244,288	27,741,025

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	48	SA7.9	Ph2	NEYCF	sim = 100	2021-05-18 00-03			
1	1,322,300	2,005,477	2,387,100	37,644	54,558	63,437	20,034,920	18,957,171	21,956,161
2	4,354,210	6,179,094	7,698,940	56,920	75,341	91,629	23,888,789	23,878,774	25,148,952
4	12,936,320	18,007,641	21,178,490	98,441	123,216	139,056	26,124,559	26,917,463	27,866,586
8	36,647,015	51,198,363	57,036,810	105,594	150,302	159,368	31,611,899	31,948,674	33,254,545
12	63,205,560	88,863,457	98,012,975	105,715	163,142	166,046	32,371,524	33,417,080	33,888,012
24	142,715,990	212,507,420	220,579,450	113,026	178,722	176,621	33,513,741	34,964,177	35,581,884

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	50	SA7.9	Ph2	NENCF	sim = 100	2021-05-18 00-41			
1	1,264,460	1,787,696	2,262,075	36,709	48,845	65,669	19,972,419	18,721,699	21,922,542
2	4,710,555	5,721,779	7,503,965	58,503	71,038	92,055	24,003,139	23,627,291	25,132,058
4	14,020,085	16,677,650	20,856,705	95,153	115,250	127,472	25,751,286	26,668,721	27,102,774
8	37,953,715	47,899,020	55,395,170	102,692	141,156	159,371	31,274,181	31,694,002	32,849,286
12	61,890,810	82,874,820	96,629,565	102,033	148,963	166,927	32,388,153	33,060,874	34,060,371
24	141,648,060	194,134,862	216,036,940	112,719	159,024	173,056	33,417,956	34,548,456	35,207,102

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	64	SA7.9	Ph3	DLYCF	sim = 100	2021-05-18 01-20			
1	1,444,630	1,940,000	2,426,650	42,307	52,643	65,473	26,134,667	25,137,644	28,381,101
2	5,339,630	6,382,641	7,910,195	75,664	86,853	110,411	31,090,092	30,846,035	32,808,692
4	19,911,930	22,590,929	28,512,995	144,078	168,342	212,679	36,515,373	38,401,857	41,364,355
8	56,184,900	67,717,751	86,412,360	158,347	202,774	240,559	44,662,435	45,950,865	48,655,820
12	97,039,725	118,189,252	145,122,385	157,914	216,239	260,779	45,522,318	47,201,582	49,671,641
24	215,677,380	281,774,612	339,679,750	165,368	233,123	274,085	47,541,740	49,370,748	51,689,313

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	65	SA7.9	Ph3	DLYAF	sim = 100	2021-05-18 02-05			
1	1,887,730	2,775,484	2,857,530	57,888	81,987	92,935	22,331,538	21,528,318	25,421,238
2	8,334,565	10,874,997	12,656,115	131,461	163,737	188,676	30,771,900	30,603,452	32,227,143
4	26,881,870	34,047,366	38,270,915	173,829	209,886	238,059	37,295,853	38,084,152	41,385,291
8	70,886,815	88,443,231	98,700,775	188,195	238,354	262,213	42,943,725	44,785,920	47,745,313
12	117,518,785	146,949,736	161,287,050	188,023	248,913	270,612	43,908,960	46,004,852	49,456,660
24	254,369,330	332,188,918	366,472,575	191,502	262,908	285,350	45,526,423	47,899,987	50,225,050

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	66	SA7.9	Ph3	DLNCF	sim = 100	2021-05-18 02-47			
1	1,324,155	2,096,662	2,482,885	35,238	55,661	69,585	26,226,133	24,989,903	28,277,395
2	4,440,160	6,727,163	8,334,885	68,653	90,348	112,134	30,544,973	30,642,074	32,345,040
4	16,101,590	22,912,373	28,399,965	128,001	165,660	198,091	37,317,552	37,569,606	39,727,013
8	49,953,150	67,436,022	80,364,555	143,799	199,323	228,323	43,658,483	45,250,234	49,363,123
12	86,696,060	117,003,313	136,760,230	150,385	211,889	240,217	44,230,999	46,763,887	50,281,589
24	198,393,515	275,931,376	316,901,175	154,152	226,830	255,097	46,265,867	48,631,515	51,349,587

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	67	SA7.9	Ph3	DLNAF	sim = 100	2021-05-18 03-33			
1	1,844,460	2,733,856	3,264,000	59,980	81,972	101,785	22,235,018	20,990,237	25,384,898
2	8,841,305	11,096,348	12,689,770	146,610	170,377	186,337	30,386,020	30,207,320	32,161,653
4	29,517,820	34,954,412	37,960,025	188,387	213,950	226,490	35,885,548	37,465,365	40,383,416
8	77,418,295	89,626,825	95,929,530	196,787	237,728	256,616	42,932,334	44,418,371	47,427,834
12	125,763,335	148,574,395	159,528,305	203,330	250,790	267,297	43,326,441	45,687,432	48,609,625
24	275,022,805	334,291,091	359,693,880	210,124	262,226	281,481	45,247,229	47,241,914	49,907,466

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	68	SA7.9	Ph3	DMYCF	sim = 100	2021-05-18 04-15			
1	1,258,000	1,887,985	2,501,050	36,873	51,846	71,035	27,630,712	27,044,658	28,993,945
2	4,470,760	6,012,056	7,883,000	61,316	76,577	97,521	30,806,791	31,153,465	31,923,300
4	14,109,625	18,754,560	25,331,120	98,724	131,549	173,134	34,264,992	35,569,295	38,166,821
8	39,702,040	55,395,912	70,453,065	112,649	167,948	200,501	40,843,470	42,463,560	44,117,290
12	68,350,715	97,284,348	120,008,120	122,241	179,804	206,894	41,437,239	43,574,168	44,874,177
24	154,936,155	232,937,950	268,869,550	124,100	194,487	210,338	43,090,191	45,434,158	47,542,718

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	69	SA7.9	Ph3	DMYAF	sim = 100	2021-05-18 04-59			
1	1,811,825	2,966,725	3,683,400	58,184	89,892	115,741	23,216,896	21,820,975	25,494,264
2	8,220,875	11,461,571	14,859,940	128,883	165,350	191,161	30,425,914	30,192,228	31,720,085
4	24,926,825	33,241,398	40,271,180	153,565	191,284	211,353	33,518,854	35,179,165	37,421,458
8	62,848,705	83,227,689	98,346,735	160,505	222,282	258,941	40,071,239	41,602,928	43,223,975
12	102,853,620	138,332,788	162,844,585	164,156	234,344	278,266	41,058,977	42,751,818	44,444,160
24	218,806,855	313,275,818	365,440,150	165,176	249,334	288,888	42,052,328	44,590,338	46,390,267

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	72	SA7.9	Ph3	DHYCF	sim = 100	2021-05-18 05-41			
1	1,020,750	1,707,098	2,073,030	31,576	47,385	65,287	26,599,412	25,491,585	28,707,020
2	3,807,210	5,485,676	7,191,215	53,830	68,631	91,189	30,164,951	30,164,953	31,246,074
4	12,308,715	16,093,263	20,108,760	91,246	111,032	129,882	32,834,211	34,189,654	37,180,660
8	36,300,485	46,354,454	56,205,205	103,963	137,500	159,673	39,315,033	40,448,241	42,867,636
12	61,340,995	80,789,618	98,597,545	105,383	148,449	177,237	40,386,552	41,683,468	43,885,229
24	140,036,560	191,947,453	232,489,380	108,835	160,093	188,237	42,102,382	43,646,562	45,750,551

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	73	SA7.9	Ph3	DHYAF	sim = 100	2021-05-18 06-23			
1	1,656,365	2,790,488	3,776,135	58,677	86,432	122,204	22,407,339	21,258,743	24,630,586
2	8,078,245	11,007,234	14,963,450	125,535	160,518	212,947	30,174,749	30,015,749	31,397,131
4	24,091,810	31,668,517	42,338,300	143,342	181,468	228,712	33,324,250	34,622,192	37,095,877
8	60,640,280	79,804,324	102,202,500	158,261	215,479	262,696	39,640,534	40,874,694	42,373,026
12	98,388,935	133,479,592	165,788,245	158,721	228,880	270,751	40,830,547	42,298,609	43,398,729
24	215,895,235	305,903,349	370,911,045	165,255	245,180	289,105	42,312,534	44,143,987	45,125,477

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	74	SA7.9	Ph3	DHNCF	sim = 100	2021-05-18 07-05			
1	972,990	1,733,132	1,723,250	30,488	48,025	58,456	27,541,796	26,356,872	29,283,847
2	3,993,135	5,550,528	6,060,690	53,945	69,567	86,920	30,513,248	30,689,782	31,616,609
4	12,366,520	16,700,264	20,901,990	91,828	117,100	145,242	34,234,282	34,882,831	37,504,252
8	35,623,175	48,529,142	60,074,560	99,224	146,639	181,802	39,753,537	41,253,839	43,054,971
12	59,305,260	85,235,983	106,155,000	105,209	156,454	188,792	40,501,804	42,382,995	43,989,453
24	136,253,500	204,019,783	245,274,715	105,150	170,313	191,507	42,366,322	44,483,550	46,353,820

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	75	SA7.9	Ph3	DHNAF	sim = 100	2021-05-18 07-47			
1	1,482,460	2,265,014	2,903,760	50,424	70,237	85,113	22,133,058	20,510,587	25,008,624
2	8,015,140	9,449,568	11,851,615	123,053	142,190	177,241	29,870,685	29,631,605	31,127,415
4	24,030,000	27,911,258	34,225,815	136,386	161,106	200,240	32,526,748	33,869,735	36,579,038
8	58,731,975	69,386,743	84,174,805	148,866	181,114	212,499	39,476,769	40,495,731	41,486,449
12	94,871,000	114,069,995	135,608,075	152,115	189,451	222,621	40,515,732	41,752,274	42,397,723
24	207,643,295	253,952,573	304,619,840	157,598	198,034	237,922	41,836,620	43,385,841	44,409,022

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	76	SA7.9	Ph3	NEYCF	sim = 100	2021-05-18 08-28			
1	1,153,150	1,809,347	2,037,930	36,091	50,511	59,400	27,488,383	25,421,715	28,392,240
2	4,451,250	5,744,802	6,446,520	61,097	71,336	84,196	30,308,133	30,343,472	31,385,204
4	13,966,730	16,918,040	19,391,385	101,844	118,524	137,548	33,177,587	34,092,594	37,030,796
8	38,990,665	50,083,048	56,799,145	107,907	153,067	162,454	39,812,471	40,986,993	42,309,906
12	65,162,860	88,638,482	99,109,155	112,929	167,007	179,886	40,825,297	42,151,608	43,499,557
24	149,986,800	214,671,118	241,329,575	120,181	180,760	198,990	42,218,742	43,978,148	45,076,853

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	77	SA7.9	Ph3	NEYAF	sim = 100	2021-05-18 09-10			
1	1,656,925	2,820,946	3,201,220	56,290	84,595	103,258	23,356,445	22,120,557	25,387,460
2	7,946,095	10,789,051	13,055,520	127,422	154,795	191,079	30,363,046	30,362,796	31,864,904
4	24,243,585	30,661,593	37,301,640	136,490	174,713	212,121	32,882,908	34,494,884	37,197,182
8	58,327,955	76,628,548	92,569,425	150,787	205,257	230,189	39,406,591	41,079,327	43,200,343
12	94,106,290	127,978,326	150,583,180	151,699	219,718	255,594	40,569,034	42,542,502	44,200,844
24	207,899,730	294,392,218	333,982,525	161,549	237,548	262,762	42,249,874	44,719,426	46,217,949

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
	median	mean	75%	median	mean	75%	median	mean	75%
Hr	78	SA7.9	Ph3	NENCF	sim = 100	2021-05-18 09-54			
1	1,190,910	1,690,846	1,942,615	35,703	46,128	51,267	27,423,079	25,326,204	29,320,479
2	4,284,425	5,375,529	6,245,720	55,057	66,967	81,767	30,383,338	30,249,904	31,553,729
4	13,102,390	15,839,865	19,018,560	91,354	110,447	134,133	32,799,956	34,375,770	36,898,866
8	37,115,560	46,063,975	57,301,035	105,914	138,115	160,558	39,966,089	40,458,181	41,832,080
12	63,460,260	80,691,143	99,404,210	112,878	148,842	177,904	40,630,775	41,753,412	42,559,194
24	143,789,375	193,469,825	236,128,120	112,664	162,089	195,184	42,240,257	43,508,911	44,614,077

Hayward Mw 7 scenario

Table 12 Selected Case results, Mw 7 Hayward scenario

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
Hr	median	mean	75%	median	mean	75%	median	mean	75%
Case	1	H7.05	Ph0	DLNCB	sim=100	2021-05-2618-02			
1	191,185	430,878	559,015	4,740	10,613	12,731	1,050,465	1,246,650	1,695,975
2	808,630	1,317,102	1,557,580	9,319	17,467	17,907	1,726,694	2,217,920	2,508,458
4	2,139,275	3,931,589	4,798,465	15,213	24,676	31,495	2,901,938	3,583,297	4,612,064
8	6,377,975	10,248,295	12,578,615	15,078	27,196	34,203	4,427,694	5,079,198	6,442,807
12	10,110,510	16,879,134	20,264,915	15,057	28,232	37,548	5,154,145	5,897,988	7,673,398
24	20,943,785	38,239,651	48,314,585	15,013	31,255	41,897	5,997,287	7,178,319	9,191,731

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	2	H7.05	Ph0	DMNCB	sim=100	2021-05-2618-13			
1	107,215	284,007	345,240	1,972	6,738	9,581	604,378	887,972	1,068,478
2	287,665	778,348	1,146,520	2,718	8,870	11,666	1,206,247	1,384,048	1,812,811
4	1,489,005	2,125,817	3,290,545	7,993	12,733	15,951	2,148,007	2,179,358	2,924,069
8	3,629,125	5,443,796	7,990,880	7,709	14,409	22,512	3,360,280	3,590,850	4,661,081
12	5,599,435	8,937,867	12,946,180	7,675	15,011	22,544	4,203,418	4,374,635	5,215,448
24	11,439,255	20,162,827	29,191,110	7,707	16,058	22,529	5,231,256	5,593,801	6,154,114

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	3	H7.05	Ph0	DHNCB	sim=100	2021-05-2618-23			
1	104,645	382,023	496,695	1,943	9,312	11,629	593,704	852,726	1,002,862
2	230,120	1,109,515	1,248,015	1,776	14,001	10,616	875,498	1,302,491	1,509,488
4	960,685	3,286,110	3,563,045	7,734	20,461	22,920	1,694,122	2,406,333	2,358,006
8	3,046,625	8,607,295	8,304,355	7,591	22,892	23,078	2,984,540	3,760,679	4,157,414
12	4,919,505	14,252,054	14,677,890	7,655	23,897	22,593	4,091,021	4,613,273	5,072,926
24	10,401,555	32,162,287	30,934,940	7,518	25,387	22,662	5,214,594	5,792,980	5,849,590

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	4	H7.05	Ph0	NENCB	sim=100	2021-05-2618-34			
1	104,280	370,464	582,880	1,878	8,158	11,853	574,688	855,287	887,333
2	292,535	992,860	1,405,435	2,840	12,270	19,615	968,569	1,244,780	1,615,939
4	1,129,545	2,885,808	4,837,060	7,746	17,522	23,824	1,734,713	2,137,277	2,349,856
8	3,101,750	7,299,819	10,925,520	7,593	19,097	30,033	3,175,004	3,647,248	4,409,472
12	4,914,530	11,999,578	17,702,095	7,577	19,898	30,125	4,088,388	4,309,411	5,062,618
24	10,480,605	27,382,510	40,021,125	7,540	22,335	30,065	5,214,594	5,641,846	5,809,874

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	20	H7.05	Ph1	NEYCF	sim=100	2021-05-2618-45			
1	141,065	472,685	542,930	2,718	10,742	11,726	960,725	1,670,718	1,961,036
2	358,095	1,398,020	1,327,795	8,418	18,830	17,369	2,133,531	2,664,849	3,369,968
4	2,054,915	4,553,101	4,452,330	8,437	29,653	34,207	3,614,482	4,503,562	5,714,520
8	4,076,180	12,004,458	13,610,290	11,769	32,271	37,678	5,869,149	6,914,649	8,208,731
12	6,846,705	20,011,288	22,839,410	15,005	34,245	37,551	6,961,398	8,162,106	9,193,640
24	19,335,495	45,469,760	49,890,745	15,011	36,615	37,500	8,932,463	10,453,074	12,391,457

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	22	H7.05	Ph1	NENCF	sim=100	2021-05-2618-58			
1	132,705	449,545	597,045	2,699	10,507	12,410	1,145,303	1,619,763	2,054,756
2	478,530	1,356,816	1,676,545	8,840	18,454	23,225	2,229,350	2,791,466	3,553,324
4	2,125,940	4,306,359	4,823,040	15,266	27,772	30,462	3,659,067	4,673,455	5,563,031
8	5,821,605	11,315,781	12,085,525	15,153	30,574	30,989	5,768,984	7,068,519	7,688,090
12	9,443,985	18,724,853	19,324,805	15,069	31,333	31,219	7,095,575	8,180,121	9,015,959
24	20,620,410	42,347,896	40,986,770	15,022	34,248	37,692	8,677,924	10,244,310	13,107,476

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	48	H7.05	Ph2	NEYCF	sim=100	2021-05-2619-11			
1	187,610	460,925	542,825	4,932	10,915	12,095	2,252,324	2,709,137	3,562,301
2	884,975	1,474,623	1,592,720	11,028	22,320	26,751	4,561,807	4,626,904	5,797,034
4	3,212,345	5,620,686	6,392,620	23,385	40,408	49,923	7,491,361	8,427,066	10,004,611
8	9,034,185	15,692,218	17,656,820	23,050	43,524	53,058	10,983,942	11,935,177	14,424,660
12	14,491,465	26,219,327	30,656,600	22,797	44,166	52,740	12,915,319	14,000,764	16,782,187
24	31,890,935	58,439,761	70,869,850	30,000	45,248	52,762	18,306,130	18,229,248	21,968,712

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	50	H7.05	Ph2	NENCF	sim=100	2021-05-2619-26			
1	168,595	605,898	651,245	4,435	14,692	13,118	2,776,793	2,842,529	3,451,382
2	862,100	1,940,837	1,823,330	12,255	28,222	29,323	3,771,139	4,588,848	5,587,925
4	3,309,360	6,683,669	6,876,815	22,835	44,812	46,488	7,374,345	8,239,910	10,293,743
8	9,180,940	17,979,768	19,924,060	22,988	49,067	57,051	10,423,575	11,582,708	14,507,221
12	15,213,475	29,959,902	33,569,835	27,903	50,744	60,091	12,589,860	13,604,201	16,338,263
24	37,608,335	68,381,517	77,630,835	30,005	55,465	60,009	17,758,149	17,437,214	22,226,906

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	64	H7.05	Ph3	DLYCF	sim=100	2021-05-2619-45			
1	559,600	709,486	970,345	13,031	18,320	23,594	4,144,787	4,531,528	6,142,329
2	1,796,790	2,620,145	3,149,750	24,306	42,807	48,839	8,609,189	8,556,246	10,745,111
4	6,496,615	10,185,151	12,388,440	45,595	71,671	90,922	13,812,019	14,903,204	17,821,527
8	17,970,680	28,086,952	36,163,970	45,449	76,442	98,224	18,971,014	20,152,935	24,162,895
12	29,079,315	46,702,611	58,765,200	45,312	78,478	97,567	21,588,378	23,484,334	28,119,428
24	62,692,750	103,827,028	126,939,270	48,873	79,984	97,637	29,502,757	30,066,646	35,166,447

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	65	H7.05	Ph3	DLYAF	sim=100	2021-05-2620-12			
1	571,760	781,562	1,092,725	12,831	20,251	27,594	4,642,210	4,957,541	6,765,229
2	1,888,710	2,617,734	3,011,400	26,678	36,435	43,027	9,548,270	9,184,416	11,414,026
4	6,298,600	8,442,885	9,039,080	38,410	54,695	66,164	14,036,139	14,470,377	17,000,499
8	15,967,560	22,804,773	26,544,390	41,499	63,482	68,463	18,675,272	20,073,486	24,309,192
12	25,204,535	38,508,955	44,603,480	42,283	66,593	80,237	21,633,375	23,288,759	26,948,540
24	56,532,665	88,373,647	107,050,025	41,442	71,182	83,318	30,287,967	30,244,480	33,052,377

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	66	H7.05	Ph3	DLNCF	sim=100	2021-05-2620-42			
1	556,035	767,401	1,028,285	11,620	20,681	27,793	4,343,959	4,771,878	6,499,583
2	1,920,990	2,902,415	3,541,780	32,938	46,642	58,652	8,530,160	9,036,025	11,205,687
4	7,356,980	10,672,391	13,586,155	53,676	72,707	94,734	14,818,061	15,150,422	18,781,889
8	20,359,370	29,031,643	37,464,840	53,322	79,173	97,692	20,320,177	20,716,439	24,917,636
12	33,016,215	48,399,046	61,207,305	52,789	81,814	98,083	22,712,574	23,884,707	29,441,356
24	72,592,400	109,038,496	131,743,180	60,007	85,505	108,963	30,838,481	30,821,315	35,024,599

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	67	H7.05	Ph3	DLNAF	sim=100	2021-05-2621-02			
1	426,555	625,983	734,090	10,324	17,476	22,151	4,048,789	4,567,609	6,328,912
2	1,395,015	2,248,397	2,687,180	18,657	33,600	39,813	8,631,576	8,450,850	10,545,382
4	5,054,945	7,780,889	9,373,805	31,482	52,093	66,404	13,932,691	14,033,028	17,120,836
8	13,175,420	20,890,514	25,050,915	37,652	56,528	67,689	18,494,707	18,954,444	22,757,801
12	21,628,170	34,799,767	41,505,595	37,586	59,111	67,725	21,894,116	22,178,748	26,024,958
24	50,166,505	79,081,740	90,557,100	37,696	63,664	67,585	29,592,336	28,965,656	33,013,490

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	68	H7.05	Ph3	DMYCF	sim=100	2021-05-2621-18			
1	379,045	691,933	755,935	9,760	19,340	24,838	3,836,925	4,224,331	5,736,370
2	1,318,825	2,634,041	3,264,975	20,689	41,108	55,262	7,352,945	7,618,113	9,259,035
4	5,912,195	9,888,983	12,777,955	39,710	69,441	91,342	12,185,740	13,182,132	16,116,775
8	16,202,050	27,307,605	36,350,215	45,248	74,553	102,588	17,239,573	18,346,219	22,362,512
12	26,617,575	45,399,334	61,556,850	45,309	76,332	109,014	19,791,687	21,127,438	26,358,964
24	59,064,640	101,802,206	140,256,160	45,190	80,284	113,948	28,297,966	27,816,156	32,521,134

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	69	H7.05	Ph3	DMYAF	sim=100	2021-05-2621-33			
1	293,745	702,490	871,330	9,117	18,671	23,074	3,678,304	3,990,624	5,776,859
2	1,277,740	2,484,022	2,729,425	17,770	37,544	39,728	6,838,697	7,414,998	9,602,620
4	4,664,660	8,837,247	9,425,765	38,059	61,029	76,335	10,929,038	11,963,282	14,759,033
8	13,725,145	24,315,319	29,213,250	37,746	66,216	82,787	15,798,105	16,943,484	20,688,115
12	22,774,700	40,360,936	49,878,465	37,629	67,332	82,584	19,552,652	20,512,945	25,165,098
24	49,831,405	89,764,187	111,239,425	37,604	69,738	86,269	27,578,535	27,149,587	31,216,844

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	72	H7.05	Ph3	DHYCF	sim=100	2021-05-2621-47			
1	267,470	704,368	750,670	7,687	18,924	19,169	3,723,417	3,704,624	5,177,279
2	1,195,495	2,566,391	2,579,680	19,892	39,140	41,040	6,541,170	7,061,772	9,285,848
4	5,417,500	9,782,377	11,475,675	42,152	70,122	86,603	10,610,997	12,961,325	15,651,502
8	15,299,510	27,356,839	35,022,875	45,234	75,231	93,964	16,372,390	18,202,785	21,542,232
12	26,033,760	45,572,140	59,468,570	45,146	76,544	101,285	19,503,211	21,421,142	25,221,837
24	59,592,750	102,122,768	132,845,480	45,167	80,181	101,264	27,697,146	28,088,325	31,357,173

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	73	H7.05	Ph3	DHYAF	sim=100	2021-05-2622-03			
1	204,255	604,009	705,935	5,105	15,251	17,143	2,885,581	3,585,805	4,280,494
2	956,405	2,023,246	2,558,965	13,327	30,901	35,274	6,191,823	6,344,240	8,461,027
4	3,680,020	7,648,073	8,668,165	30,726	53,846	68,216	10,135,466	11,243,180	14,138,613
8	10,991,680	21,466,160	29,210,110	30,147	59,778	78,960	14,419,586	15,877,196	18,686,207
12	18,248,135	36,058,628	49,091,670	30,178	61,518	79,166	17,378,064	19,147,093	24,145,432
24	40,358,380	81,576,344	107,820,545	30,072	64,857	82,530	25,406,828	25,936,889	30,244,400

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	74	H7.05	Ph3	DHNCF	sim=100	2021-05-2622-20			
1	232,245	740,310	823,185	7,536	19,471	20,888	3,720,038	3,877,523	5,194,834
2	1,052,115	2,528,556	2,577,955	15,731	37,132	41,450	6,407,699	6,792,082	8,908,468
4	4,369,210	9,249,293	10,392,140	38,049	64,826	79,708	11,174,925	11,880,962	14,240,688
8	13,270,230	25,650,701	29,924,935	37,869	70,966	81,736	15,354,215	17,067,895	20,440,253
12	22,396,100	42,896,318	49,053,230	37,856	72,696	82,793	18,841,771	20,227,169	24,490,015
24	51,346,385	97,030,302	109,474,180	41,375	76,808	90,151	27,548,438	27,038,902	30,637,056

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	75	H7.05	Ph3	DHNAF	sim=100	2021-05-2622-35			
1	258,410	560,767	751,400	7,083	13,919	14,767	3,466,092	3,601,753	4,566,511
2	1,235,835	1,908,872	1,979,215	16,373	29,359	31,474	6,421,117	6,729,795	8,792,360
4	4,115,605	7,081,394	7,549,090	30,570	49,482	53,732	9,884,659	11,260,458	13,091,398
8	11,888,315	19,448,811	21,679,185	30,307	52,911	64,732	14,190,176	15,670,913	17,531,188
12	19,388,695	32,355,389	37,032,150	30,199	54,343	63,859	16,996,798	18,724,283	22,586,017
24	41,078,115	72,262,249	83,071,690	30,133	56,278	63,988	25,670,607	25,658,380	28,816,824

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	76	H7.05	Ph3	NEYCF	sim=100	2021-05-2622-51			
1	265,840	581,875	742,270	8,690	14,459	18,024	3,123,844	3,584,571	4,658,739
2	1,293,800	2,060,257	2,360,755	18,176	32,763	41,378	6,489,374	6,672,228	8,582,495
4	5,169,470	8,570,023	11,155,450	45,800	64,464	83,974	11,047,341	11,845,342	13,649,334
8	16,318,100	24,657,300	30,134,485	45,391	67,996	86,823	15,797,747	16,774,207	19,455,238
12	27,142,560	41,133,436	51,280,530	45,132	69,112	91,607	18,799,026	19,740,624	22,252,969
24	59,592,065	92,216,102	116,160,090	45,068	72,299	90,715	27,381,040	26,845,468	30,513,870

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	77	H7.05	Ph3	NEYAF	sim=100	2021-05-2623-06			
1	227,600	546,532	764,415	5,428	12,489	13,537	3,373,423	3,535,187	4,136,442
2	1,038,305	1,732,100	2,052,685	13,447	25,804	30,449	6,157,260	6,413,462	8,219,391
4	4,274,460	6,684,645	8,460,500	37,716	48,793	60,803	10,906,833	11,174,141	13,016,360
8	13,443,520	19,342,941	23,672,870	37,728	55,113	69,157	15,676,931	16,070,391	18,917,902
12	22,620,490	32,735,319	39,936,365	37,606	56,534	77,844	19,866,049	19,421,209	23,631,715
24	50,156,305	74,954,143	96,532,445	37,686	61,132	82,501	27,607,146	26,025,028	30,104,673

	Total Required Water Flow (gallons)			Required Water Flow (gpm)			Burnt TFA (sq ft)		
hour	median	mean	75%	median	mean	75%	median	mean	75%
Case	78	H7.05	Ph3	NENCF	sim=100	2021-05-2623-21			
1	245,855	717,125	875,760	6,253	17,871	19,994	3,430,958	3,749,359	4,651,919
2	1,090,175	2,375,770	2,639,960	22,435	35,680	41,590	6,688,487	6,939,868	8,549,734
4	5,595,790	9,080,773	10,545,120	46,009	65,701	87,032	10,284,331	12,013,369	14,378,689
8	17,867,050	25,549,647	32,337,395	52,551	71,097	90,135	15,479,030	17,098,618	19,103,571
12	30,598,420	42,872,058	54,938,670	52,603	73,074	93,880	19,268,788	20,698,135	24,513,460
24	69,247,375	96,748,442	124,885,215	52,871	76,020	97,500	27,379,774	27,148,098	30,578,687

6 REFERENCES

ABAG. 2021. "ABAG Draft RHNA Methodology Report 2023-2031." Pp. 111. San Francisco: Assn. Bay Area Governments.

Abrahamson, Norman A, Walter J Silva, and Ronnie Kamai. 2014. "Summary of the ASK14 ground motion relation for active crustal regions." *Earthquake Spectra* 30(3):1025-55.

Anderson, D., R.A. Davidson, K. Himoto, and C. Scawthorn. 2016. "Statistical Modeling Of Fire Occurrence Using Data From The Tōhoku, Japan Earthquake And Tsunami." *Risk Analysis* 36(2):378-95.

ATC-52-1. 2010. "Here Today—Here Tomorrow: The Road To Earthquake Resilience In San Francisco, Potential Earthquake Impacts." San Francisco: Prepared for the Department of Building Inspection, City and County of San Francisco, under the Community Action Plan for Seismic Safety (CAPSS) Project by the Applied Technology Council.

ATC-52-1A. 2010. "Here Today—Here Tomorrow: The Road To Earthquake Resilience In San Francisco, Potential Earthquake Impacts: Technical Documentation." Pp. 178. San Francisco: Prepared for the Department of Building Inspection, City and County of San Francisco, under the Community Action Plan for Seismic Safety (CAPSS) Project by the Applied Technology Council.

Benfer, Matthew E., and Joseph L. Scheffey. 2015. *Evaluation of Fire Flow Methodologies*. New York, NY: Springer New York.

Boore, David M, Jonathan P Stewart, Emel Seyhan, and Gail M Atkinson. 2014. "NGA-West2 equations for predicting PGA, PGV, and 5% damped PSA for shallow crustal earthquakes." *Earthquake Spectra* 30(3):1057-85.

Campbell, Kenneth W, and Yousef Bozorgnia. 2014. "NGA-West2 ground motion model for the average horizontal components of PGA, PGV, and 5% damped linear acceleration response spectra." *Earthquake Spectra* 30(3):1087-115.

Chiou, Brian S-J, and Robert R Youngs. 2014. "Update of the Chiou and Youngs NGA model for the average horizontal component of peak ground motion and response spectra." *Earthquake Spectra* 30(3):1117-53.

CS-199. 2014. "Planning Support Services For Auxiliary Water Supply System (Awss), Final Report." Pp. 288. San Francisco: CS-199 Project Report Prepared for San Francisco Public Utilities Commission by AECOM/AGS JV.

Davidson, Rachel A., James Kendra, Sizheng Li, Laurie C. Long, David A. McEntire, and Charles Scawthorn. 2012. "San Bruno California, September 9, 2010 Gas Pipeline Explosion And Fire." Pp. 210. Newark: Disaster Research Center, University of Delaware.

Davis, S.K. 2000. "Fire Fighting Water: A Review Of Fire Fighting Water Requirements, A New Zealand Perspective." in *School of Engineering*. Christchurch, New Zealand: University of Canterbury.

Detweiler, S.T., and A.M. Wein (Eds.). 2017. *The HayWired earthquake scenario—Earthquake hazards (ver. 1.1, March 2018):*. Washington: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, available at https://pubs.er.usgs.gov/publication/sir20175013v1.

DHS. 2003. "Multi-Hazard Loss Estimation Methodology, Earthquake Model, Hazus-Mh Mr3 Technical Manual." Pp. 699pp. Washington, DC.: Developed by: Department of Homeland

Security, Emergency Preparedness and Response Directorate, FEMA Mitigation Division Washington, D.C. Under a contract with: National Institute of Building Sciences.

Eqe/ags. 1989. "San Francisco Fire Department Facilities Seismic Evaluation Study - Summary Report." Pp. 250pp. San Francisco: Prepared By EQE/AGS Under Contract to Department of Public Works, City and County of San Francisco, for San Francisco Fire Commission; C. Scawthorn, Principal in Charge; R. Hamburger, Project Manager.

FEMA. 2003. "Multi-Hazard Loss Estimation Methodology, Earthquake Model, Hazus-Mh Mr4 Technical Manual." Pp. 712. Washington, D.C.: Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Under a contract with: National Institute of Building Sciences.

Freeman, John Ripley. 1932. *Earthquake Damage And Earthquake Insurance; Studies Of A Rational Basis For Earthquake Insurance, Also Studies Of Engineering Data For Earthquake-Resisting Construction*. New York: McGraw-Hill.

Gregor, Nick, Norman A Abrahamson, Gail M Atkinson, David M Boore, Yousef Bozorgnia, Kenneth W Campbell, Brian S-J Chiou, IM Idriss, Ronnie Kamai, and Emel Seyhan. 2014. "Comparison of NGA-West2 GMPEs." *Earthquake Spectra* 30(3):1179-97.

Grimwood, Paul, and Cliff Barnett. 2005. "'Fire-Fighting Flow-Rate.' London Fire Brigade (Retired)." ". www. firetactics. com.

Hadjisophocleous, G. V., and J. K. Richardson. 2005. "Water Flow Demands For Firefighting." *Fire Technology* 41(3):173-91.

Jayaram, Nirmal, and Jack W Baker. 2009. "Correlation model for spatially distributed ground-motion intensities." *Earthquake Engineering & Structural Dynamics* 38(15):1687-708.

Johnson, Kenneth A., and Greg W. Bartow (Eds.). 2018. *Geology of San Francisco, California, United States of America*. Issued to registrants at the 61st Annual Meeting of the Association of Environmental & Engineering Geologists and 13th International Association of Environmental & Engineering Geologists Congress in San Francisco, CA: Association Engineering Geologists.

Kiran, KC, and Jonathan Corcoran. 2017. "Modelling residential fire incident response times: A spatial analytic approach." *Applied Geography* 84:64-74.

Knudsen, Keith L., Janet M. Sowers, Robert C. Witter, Carl M. Wentworth, and Edward J. Helley. 2000. "Description Of Mapping Of Quaternary Deposits And Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California, Open-File Report 00-444, Part 3." Pp. 60. Washington: U.S. Geological Survey.

Lee, Selina, Rachel Davidson, Norihito Ohnishi, and Charles Scawthorn. 2008. "Fire Following Earthquake - Reviewing The State-Of-The-Art Of Modeling." *Earthquake Spectra* 24(4):933-67pp.

LMA. 2010. "California Earthquake Risk - Report from the LMA Lloyd's Market Academy Earthquake Seminar in San Francisco " Pp. 44. London: Lloyd's Market Academy

Manson, M., H. D. H. Connick, T. W. Ransom, and W. C. Robinson. 1908. "Reports On An Auxilary Water Supply System For Fire Protection For San Francisco, California." Pp. 173 p. San Francisco, Calif.,: San Francisco Board of Public Works.,.

NBFU. 1905. "Report Of National Board Of Fire Underwriters By Its Committee Of Twenty On The City Of San Francisco, Cal., Henry Evans, Chmn." Pp. 64pp.

O'Rourke, T. D., Scawthorn C. R., Blackburn E. T., Dickerman, T. S. 1990. "Response Of The San Francisco Water Supply System During The 1989 Loma Prieta Earthquake." Conference organized by California Governor's Office of Emergency Services and the Earthquake Engineering Research Institute, San Francisco, CA, Oct. 1990, 10 p.

O'Rourke, T.D., P. A. Beaujon, and C. R. Scawthorn. 1992. "Large Ground Deformations And Their Effects On Lifeline Facilities: The 1906 San Francisco Earthquake." in *in O'Rourke T D. Hamada M editors. Case Studies Of Liquefaction And Lifeline Performance During Past Earthquakes: Volume 2 United States Case Studies*: National Center for Earthquake Engineering Research, State University of New York, Buffalo, NY, February 1992., REPORT: NCEER-92-0002, ISSN: 1088-3800.

Odell, Kerry A., and Marc D. Weidenmier. 2004. "Real Shock, Monetary Aftershock: The 1906 San Francisco Earthquake And The Panic Of 1907." *Journal of Economic History* 64(4):1002-27.

Planning Department. 2020. "2019 San Francisco Housing Inventory." Pp. 84. San Francisco: San Francisco Planning Department.

Porter, K.A. 2018. "A new model of water-network resilience, with application to the HayWired scenario." in *The HayWired earthquake scenario—Engineering Implications: chap. N* edited by S.T. Detweiler, and Wein, A.M.: U.S. Geological Survey Scientific Investigations Report 2017–5013–I–Q.

Porter, K.A., C.R. Scawthorn, and D. Sandink. 2021. "An Impact Analysis for the National Guide for Wildland-Urban Interface Fires - Overview." Pp. 5. Toronto, ON, : Prepared for the National Research Council of Canada, Institute for Catastrophic Loss Reduction.

Porter, keith, lucile jones, dale cox, james goltz, ken hudnut, dennis mileti, sue perry, daniel ponti, michael reichle, adam z. rose, Charles r. Scawthorn, hope a. Seligson, kimberley i. Shoaf, jerry Treiman, and anne wein. 2011. "The Shakeout Scenario: A Hypothetical Mw7.8 Earthquake On The Southern San Andreas Fault." *Earthquake Spectra* 27(2):239-61.

Reed, s. Albert. 1906. *The San Francisco Conflagration Of April, 1906 : Special Report To The National Board Of Fire Underwriters, Committee Of Twenty*. New York: National Board of Fire Underwriters.

Särdqvist, Stefan. . 1998. ""Real fire data: Fires in non-residential premises in London 1994-1997." ". Lund: Department of Fire Safety Engineering, Lund Institute of Technology, Lund University.

Scawthorn, C. 2018a. "Fire following the Mw 7.05 HayWired earthquake scenario." Pp. 367-400 in *The HayWired Earthquake Scenario—Engineering Implications*, edited by Shane T. Detweiler and Anne M. Wein. Washington: U.S. Geological Survey Scientific Investigations Report 2017–5013–I–Q.

Scawthorn, c. . 2008. "Enhancements In Hazus-Mh Fire Following Earthquake." Pp. 45pp: SPA Risk LLC Prepared for PBS&J and the National Institute of Building Sciences.

Scawthorn, C., J. M. Eidinger, and A.J. Schiff (Eds.). 2005. *Fire Following Earthquake*. Reston: American Society of Civil Engineers.

Scawthorn, C., Frank T. Blackburn. 1990a. "Performance Of The San Francisco Auxiliary And Portable Water Supply Systems In The 17 October 1989 Loma Prieta Earthquake." in *4th U.S. National Conference on Earthquake Engineering*. Palm Springs, CA.

Scawthorn, C., Khater M. 1992. "Fire Following Earthquake - Conflagration Potential In The Greater Los Angeles San Francisco Seattle And Memphis Areas." in *prepared for the Natural Disaster Coalition by EQE International*: San Francisco, CA. [EQE's study for the Natural Disaster Coalition, Fire Following Earthquake in the Greater Los Angeles, San Francisco, Seattle and Memphis Areas, is available from the National Committee on Property Insurance, 75 Tremont Street, Suite 510, Boston, MA 02108-3910, (617. 722-0200.].

Scawthorn, c., and T. D. O'rourke. 1989. "Effects Of Ground Failure On Water Supply And Fire Following Earthquake: The 1906 San Francisco Earthquake." in *Proceedings 2nd U.S. - Japan Workshop on Large Ground Deformation*. Buffalo.

Scawthorn, C. R., O'Rourke T. D., Khater M. M., Blackburn, F. 1990b. "Loma Prieta Earthquake And San Francisco Awss: Analysis And Observed Performance." San Francisco, CA: National Center for Earthquake Engineering Research, Buffalo, NY, pp. 527-540.

Scawthorn, C., Y. Yamada, and H. Iemura. 1981. "A Model For Urban Postearthquake Fire Hazard." *Disasters* 5(2):pp. 125-32.

Scawthorn, C., Y. Yamada, H. Iemura, and M. Kobayashi. 1982. "A Model For Urban Post-Earthquake Fire Hazard." *Transactions Arch. Institute of Japan*.

Scawthorn, Charles. 1987. *Fire Following Earthquake: Estimates Of The Conflagration Risk To Insured Property In Greater Los Angeles And San Francisco*. Oak Brook, Ill.: All-Industry Research Advisory Council.

—. 2012. "Memorandum to D. Myerson re Water Demand results." Pp. 3 pgs with attached data files.

—. 2018b. "Fire Following the Mw 7.05 Haywired Earthquake Scenario." Pp. 12 in *Eleventh U.S. National Conference on Earthquake Engineering - Integrating Science, Engineering & Policy*. Los Angeles, California.

—. 2020. "Fire following earthquake in the Vancouver region." Ontario: Institute for Catastrophic Loss Reduction, available at https://www.iclr.org/wp-content/uploads/2020/11/Vancouver-fire-following-earthquake-E.pdf and video recording presentation available at https://youtu.be/y7lKTU58x5I.

Scawthorn, Charles, Andrew D. Cowell, and Frank Borden. 1998. "Fire-Related Aspects Of The Northridge Earthquake." Pp. 165pp. Gaithersburg, MD: NIST GCR 98-743; National Institute of Standards and Technology Building and Fire Research Laboratory.

Scawthorn, Charles, and et al. 2018. "Fire Following the Mw 7.0 HayWired Earthquake." in *11th National Conference on Earthquake Engineering*. Los Angeles: Earthquake Engineering Research Institute.

Seed, H.B. , and I.M. Idriss. 1982. "Ground Motions and Soil L iquefaction during Earthquakes, Monogr. 5, ." Berkeley.: Earthquake Engineering Research Institute and the University of California, .

SFFD. 2009. "Apparatus Inventory." Pp. 112: San Francisco Fire Department.

SPA Risk. 2009. "Enhancements In Hazus-Mh Fire Following Earthquake, Task 3: Updated Ignition Equation " Pp. 74pp. San Francisco: SPA Risk LLC, Berkeley CA. Principal Investigator C. Scawthorn. Prepared for PBS&J and the National Institute of Building Sciences.

Steinbrugge, Karl, V. 1968. "Earthquake Hazard In The San Francisco Bay Area: A Continuing Problem In Public Policy " Pp. x, 80pp: Institute of Governmental Studies, University of California, Berkeley.

Steinbrugge, Karl v., eugene e. Schader, harry c. Bigglestone, and carl a. Weers. 1971. *San Fernando Earthquake, February 9, 1971*. San Francisco, Calif.: Pacific Fire Rating Bureau.

TCLEE (Ed.). 2005. *Fire Following Earthquake*. Reston: American Society of Civil Engineers, Technical Council for Lifeline Earthquake Engineering, Scawthorn et al (eds).

Van Anne, Craig, Charles Scawthorn, and Dennis S. Mileti. 1994. *The Loma Prieta, California, Earthquake Of October 17, 1989 : Fire, Police, Transportation, And Hazardous Materials*. Washington: U.S. Geological Survey.

Whitney, Albert W. 1906. *On Insurance Settlements Incident To The 1906 San Francisco Fire*. Pasadena, Calif.: reprint by the Center for Research on the Prevention of Natural Disasters Division of Engineering and Applied Science California Institute of Technology, 1972.

Wills, CJ, CI Gutierrez, FG Perez, and DM Branum. 2015. "A Next Generation VS30 Map for California Based on Geology and TopographyA Next Generation VS30 Map for California Based on Geology and Topography." *Bulletin of the Seismological Society of America* 105(6):3083-91.

Zio, Enrico. 2013. *The Monte Carlo Simulation Method for System Reliability and Risk Analysis.* London ; New York: : Springer.

EFWS Seawater Supply

Pre-Feasibility Study

San Francisco Public Utilities Commission

Project number: 60641951

4 June 2021

Quality information

Prepared by	Checked by	Approved by
J. Orlins, PE, PhD, PMP	C. Smith, PE	J. Orlins, PE, PhD, PMP

Revision History

Revision	Revision date	Details	Name	Position
0	4 December 20	Initial DRAFT	J. Orlins	Task Lead
1	16 December 20	Incorporated preliminary feedback	J. Orlins	Task Lead
2	24 April 21	Incorporated additional feedback, added Appendix H with comments & resolution of comments	J. Orlins	Task Lead
3	4 June 21	Final; removed Appendix H	J. Orlins	Task Lead

Prepared for:

San Francisco Public Utilities Commission

Prepared by:

AECOM
1111 Third Avenue
Suite 1600
Seattle, WA 98101
aecom.com

Table of Contents

Appendices

Figures

Tables

Acronyms and Abbreviations

AWSS	Auxiliary Water Supply System
BAAQMD	Bay Area Air Quality Management Districts
BART	Bay Area Rapid Transit
BCDC	Bay Conservation and Development Commission
bgs	below ground surface
CalAm	California American Water Company
Caltrans	California Department of Transportation
CCC	California Coastal Commission
CCSF	City and County of San Francisco
CDD	City Distribution Division
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CS-199	AWSS Engineering Services Contract CS-199
CSLC	California State Lands Commission
CWA	Clean Water Act
DFPS	dedicated fire protection system
DIP	ductile iron pipe
EA	environmental assessment
EFH	essential fish habitat
EFWS	emergency firefighting water system
EIR	environmental impact report
EIS	environmental impact statement
EQ	earthquake
ESA	Endangered Species Act
ESCP	erosion sediment control plan
ESER	earthquake safety and emergency response
FEMA	Federal Emergency Management Agency
ft.	Feet or foot
FIRM	flood insurance rate maps
fps	feet per second
FRA	fire response area
GGNRA	Golden Gate National Recreation Area
gpm	gallons per minute
HDPE	high-density polyethylene
ID	inside diameter

in.	inches or inch
LCP	Local Coastal Program
MG	Million gallons
MPWSP	Monterey Peninsula Water Supply Project
MW	megawatt
MWSS	municipal water supply system
N/A	not applicable
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
PEFWS	potable emergency firefighting water system
psi	pounds per square inch
PWSS	potable water supply system
RWQCB	Regional Water Quality Control Board
SF	San Francisco
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utilities Commission
SHPO	State Historic Preservation Officer
SSMP	sewer system management plan
SWPPP	storm water pollution prevention plan
SWPS	seawater pump station
SWRCB	State Water Resources Control Board
TBD	to be determined
USACE	US Army Corps of Engineers
USCG	US Coast Guard
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WDR	waste discharge requirement
WSP	Welded steel pipe

Executive Summary

The San Francisco Public Utilities Commission (SFPUC) is actively improving and planning expansions to its existing infrastructure for the Emergency Firefighting Water System (EFWS). At present, the existing EFWS does not provide coverage over the entire city of San Francisco. SFPUC is evaluating several measures to expand the system to enhance firefighting capabilities in areas of the city that are not served by the present EFWS and to improve overall supply reliability.

The primary purpose of this pre-feasibility study is to identify the factors that will need to be considered for development of additional seawater supply sources for the EFWS. The goal of the study is not to develop recommendations for siting one or more new seawater pump stations or answer all the questions regarding feasibility; the goal is to document items that will need to be considered in future evaluations. The scope of the study includes regulatory and engineering aspects, as well as rough estimates of costs for different types of potential seawater pumping stations (SWPS) to aid in further planning.

Flow Requirements Evaluated

It is anticipated that regional water mains will be avaliable within 24 hours of a major seismic event, but local supply sources will be required in the immediate aftermath. Although the existing, currently planned and potential supplemental supply sources for the City can meet post-earthquake fire demands, water storage within the city will be severely impacted. For example, under some modeled scenarios, the Twin Peaks Reservoir (currently the primary EFWS storage facility) may not be able to supply flow beyond 6 hours. Within three days, most of the potable reservoirs may reach a low level where they are no longer available for fire fighting. Only Lake Merced, with its nearly 2 billion gallons of capacity, can maintain a significant storage over the 5-day period.

Cisterns and fireboats will likely be required in the initial hours after an earthquake. Secondary water sources can meet not only firefighting demands, but also reduce the impact on the potable reservoirs. Supplemental sources include other potable reservoirs such as Merced Manor, Stanford Heights, and College Hill Reservoirs as well as nonpotable sources such as Lake Merced or new seawater intake supplies.

Based upon currently projected demands, the maximum amount of supply deficit is approximately 40,000 gallons per minute (gpm). For the purposes of this pre-feasibility study, new seawater intake supplies with flows from 3,000 gpm to 50,000 gpm are considered.

Regulatory Considerations

Primary shoreline regulatory agencies (those typically having a final say in the overall approval process) vary depending on the location of off-shore and near-shore intake structures, pipelines, and other infrastructure.

The California Coastal Commission (CCC) and National Park Service (NPS) will be the primary shoreline regulatory agencies on the ocean side of the city west of the Golden Gate Bridge. On the bay side, the Bay Conservation and Development Commission (BCDC) is the primary shoreline decision making body.

Other regulatory jurisdictions or entities include the California State Lands Commission (CSLC), State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), US Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), US Coast Guard (USCG), Port of San Francisco and the Presidio Trust.

The potential challenge or degree of difficulty in obtaining permits from the primary shoreline regulatory agencies is generally moderate to high. The CCC and SWRCB are likely to have the most stringent requirements; BCDC is expected to have a less onerous and more streamlined review and approval process in comparison.

One of the greatest permitting challenges for implementing additional seawater sources to the EFWS will be approval of a new seawater withdrawal from either the Pacific Ocean or San Francisco Bay. The California Ocean Plan requires subsurface seawater intakes (assuming they are feasible), rather than open water intakes. If subsurface intakes are not feasible, open water intakes must be screened to reduce entrainment of marine life. This typically requires screens with openings less than 1.0 mm, to prevent entrainment of small aquatic organisms. To minimize impingement of marine life on open water intake screens, the through-screen velocity must generally be less than 0.5 feet per second. Similar (though perhaps slightly less stringent) open water intake criteria exist for waters on the bay side of the City under the BCDC Bay Plan, in which subsurface intake systems in silty muds are deemed infeasible. With any screening system for open water intakes, consideration must be made for screen cleaning and inhibition of growth of marine organisms.

It should be noted that the existing Pump Stations 1 and 2, fireboats, and suction connections for the EFWS do not meet these current requirements. Since the use of seawater intakes to supplement the EFWS will not be a regular, ongoing withdrawal of seawater from either the ocean or the bay, the regulatory agencies may be amenable to relaxation of their normal requirements.

Regions of City Considered for Seawater Intakes

Based upon the geogrpahy of San Francisco and the division of primary regulatory jurisdicitons, evaluation of potential seawater intakes for expansion of the EFWS was considered in five sub-regions of the City. These shoreline subregions include the Southern Dunes, Rocky Area South, Rocky Area North, North Bayfront, and East Bayfront.

Engineering Factors Considered

For each of the five sub-regions, the distance from the shoreline to the closest tie-in point of the existing EFWS and the elevation differences between these locations were used to determine required pipeline lengths, diameters and pump discharge pressures for flows ranging from 3,000 gpm to 50,000 gpm. For the present study, seawater intakes for these areas were considered for supplementing the existing EFWS, and not connecting to the Potable EFWS (PEFWS) on the west side of the city.

The sizes of piping to connect new seawater intakes to the existing EFWS for flows in this range (20 to 50 inches) are generally larger than the pipes in the existing EFWS at the closest connection points (typically 12 to 20 inches), especially at the western extents of the existing EFWS. This may cause issues with providing additional flows at suitable pressures to an expanded system, and may require “up-sizing” (increasing the diameter) of existing EFWS piping in certain areas or making tee connections to the existing piping (to provide two discharge paths). That level of analysis is beyond the scope of this pre-feasibility study.

Both open water intakes and slant wells (a type of subsurface intake) were included in this pre-feasibility study. In general, either type of intake is viable from an engineering perspective (though perhaps not a permitting one) in the three subregions on the ocean side of the City. Due to the sediment formations and geology of San Francisco Bay, an open water intake is considered the only viable intake type for the two subregions on the bay side of City.

The number of pumps required to supply seawater to the EFWS is a function of the overall flows required and type of intake. For a flow of 20,000 gpm, three conventional pumps rated at 10,000 gpm each (2 duty, 1 standby), fed by an open water intake would be suitable. For the same flow, 8 submersible pumps mounted in slant wells rated at 3,000 gpm each (7 duty, 1 standby) would likely be required. For smaller or larger flows, the number and capacity of pumps changes accordingly.

Costs

Order-of-magnitude cost estimates for new intake seawater supplies for each of the five subregions were developed for pump station flows ranging from 3,000 to 50,000 gpm. Initial design, permitting, and construction costs are generally lowest for pump stations fed by open water intakes on the bay side of the City, and greatest for open water intakes on the ocean side of the city. Initial costs for slant well intakes on the ocean side are generally in the middle range.

For a total flow of 3,000 gpm (representing a small pump station), the present value initial cost for an open water intake would cost approximately $25M on the bay side; a slant well intake would cost approximately $40M on the ocean side; and an open water intake on the ocean side would cost approximately $68M. For a total flow of 40,000 gpm (representing a large pump station), the present value initial cost for an open water intake would cost approximately $93M on the bay side; a slant well intake would cost approximately $145M on the ocean side; and an open water intake on the ocean side would cost over $180M.

When lifecycle costs are considered (assuming a 15-year replacement cycle for major components), open water intakes on the bay side will still be the least expensive; costs for either slant wells or open water intakes on the ocean side are on average at least twice that of an open water intake on the bay. For a total flow of 3,000 gpm, lifecycle cost (including initial costs, annual operations & maintenance, and periodic renewal) for an open water intake on the bay side would cost approximately $36M; a slant well intake would cost approximately $55M on the ocean side; and an open water intake on the ocean side would cost approximately $78M. For a total flow of 40,000 gpm, lifecycle costs for an open water intake on the bay side would cost approximately $116M; a slant well intake would cost approximately $286M on the ocean side; and an open water intake on the ocean side would cost at least $200M.

Next Steps

Advancing the concept of additional seawater intake supplies to the City's EFWS will require further engineering and analysis, including assessment of flow requirements, refinement of engineering aspects, environmental / permitting requirements, and operational & maintenance considerations.

SFPUC is currently conducting a long-range planning study for the EFWS, taking into consideration currently planned and potential future modifications to the overall EFWS system. That study will provide further definition of the required supplemental flows, both in terms of quantity and geographic region where flows are required.

From a regulatory and permitting perspective, it will be important to identify the relevant lead agencies early once a preferred course of action has been identified. Understanding and early coordination of environmental compliance and permit acquisition efforts will ease the overall compliance process.

Chapter 1: Introduction

The San Francisco Public Utilities Commission (SFPUC) is actively improving and planning expansions to its existing infrastructure for the Emergency Firefighting Water System (EFWS). The existing EFWS does not provide coverage over the entire city of San Francisco (SF). SFPUC is evaluating several measures to expand the system to enhance firefighting capabilities in areas of the city that are not served by the present EFWS and to improve supply reliability.

1.1 Background

The EFWS provides water solely for fire suppression; it is a high-pressure, earthquake-resilient system that is separate from the regular Municipal Water Supply System (MWSS). The EFWS is used by the San Francisco Fire Department (SFFD) to protect against the loss of life and property from fire following an earthquake and is also used to suppress non-earthquake multiple-alarm fires.

The EFWS is currently supplied with water from multiple sources including existing water supply tanks and reservoirs and two seawater pump stations located on the northeast side of the city. Additional water for firefighting can be provided by three fireboats (which can pump water from San Francisco Bay into the EFWS system), 52 suction manifolds along the waterfront, and water storage cisterns located in various parts of the City.

In 2019, the City and County of San Francisco Civil Grand Jury issued a report on the City's firefighting system[1], which made several recommendations regarding improvements to the EFWS system. Specifically, recommendation No. 6 of the report states:

> *R6. The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.*

1.2 Purpose and Scope

The purpose of this study is to identify the factors that will need to be considered for development of additional seawater supply sources for the EFWS. The goal of the study is not to develop recommendations for siting one or more new seawater pump stations or answer all the questions regarding feasibility; the goal is to document items that will need to be considered in future evaluations. The scope of the study includes regulatory and engineering aspects, as well as estimation of order-of-magnitude costs for various seawater intake concepts.

1.3 Organization of Report

This pre-feasibility study is divided into 10 main chapters:

- Chapters 1 and 2 provide an introduction and background of the existing EFWS and currently planned improvements.

[1] City and County of San Francisco 2018-2019 Civil Grand Jury, 2019. *Act Now Before It is Too Late: Aggressively Expand and Enhance our High-Pressure Emergency Firefighting Water System.*

- Chapter 3 summarizes the existing water supply sources and the potential flow requirements from new sources.
- Chapter 4 provides an overview and details of the regulatory aspects related to development of new seawater supplies for the EFWS, including the environmental permitting process and relevant regulatory jurisdictions and requirements.
- Chapter 5 discusses potential locations for new seawater pumping facilities for expansion of the EFWS.
- Chapter 6 documents the engineering aspects, geologic, geotechnical, and coastal hazards that must be considered for pumping stations located on either the Pacific Ocean and San Francisco Bay sides of the City, along with operations and maintenance and security considerations.
- Chapter 7 describes the different types of seawater intakes that could be used to provide seawater for expansion of the EFWS.
- Chapter 8 discusses the need for coordination and integration with other development and redevelopment activities within the city.
- Chapter 9 provides an estimate of construction and operations costs for the types of pumping systems envisioned.
- Finally, Chapter 10 summarizes the items that will need to be addressed in the next stages of project development.

Chapter 2: Background Information

This chapter provides background information regarding existing and prospective EFWS facilities, key prior studies, other potential infrastructure that could potentially support an expanded EFWS and summarizes similar infrastructure established by other municipalities globally.

2.1 EFWS Facilities

The EFWS presently consists of the following components:

- Auxiliary water supply system (AWSS): A high-pressure standalone fire protection water supply system which was constructed following the fires and devastation of the 1906 San Francisco earthquake.
- Cisterns: Below-grade water storage tanks for water supply for fire suppression
- Storage reservoirs and tanks consisting of Twin Peaks Reservoir, Ashbury Tank, and Jones Street Tank
- Portable water supply system (PWSS): 5-inch portable hose units which extend the range of SFFD assets
- Two seawater pump stations: Draw water from the bay and inject it at high pressure into the EFWS (AWSS)
- Suction connections: Waterfront bay suction points for bay water supply for fire suppression
- Fireboat manifolds: Points of connection for bay water supply for fire suppression from fireboats
- Fulton Street emergency hydrants: Low pressure emergency hydrants using Stow Lake in Golden Gate Park as source of water

Figure 2-1 shows the components of the EFWS, apart from the PWSS.

The City Distribution Division (CDD) of SFPUC is responsible for the operation and maintenance of the EFWS. During firefighting events, CDD coordinates with the San Francisco Fire Department (SFFD) to enable the proper operation of the system to respond to the dynamic needs of the fire.

The Earthquake Safety and Emergency Response (ESER) bonds approved by voters in 2010, 2014 and 2020 provided SFPUC with funds to plan, design, and construct projects to expand and enhance the reliability of the EFWS in San Francisco. Figure 2-1 also shows the improvements completed or funded through the 2010 and 2014 ESER Bonds.

The two existing seawater pump stations (PS1 and PS2) can each provide up to approximately 10,800 gpm of seawater from San Francisco Bay to the high-pressure EFWS at 300 psi. Because they convey seawater, which is corrosive to metallic piping such as that used in the EFWS, these pump stations are intended for use only after a major seismic event when additional water for fire suppression is expected to be needed.

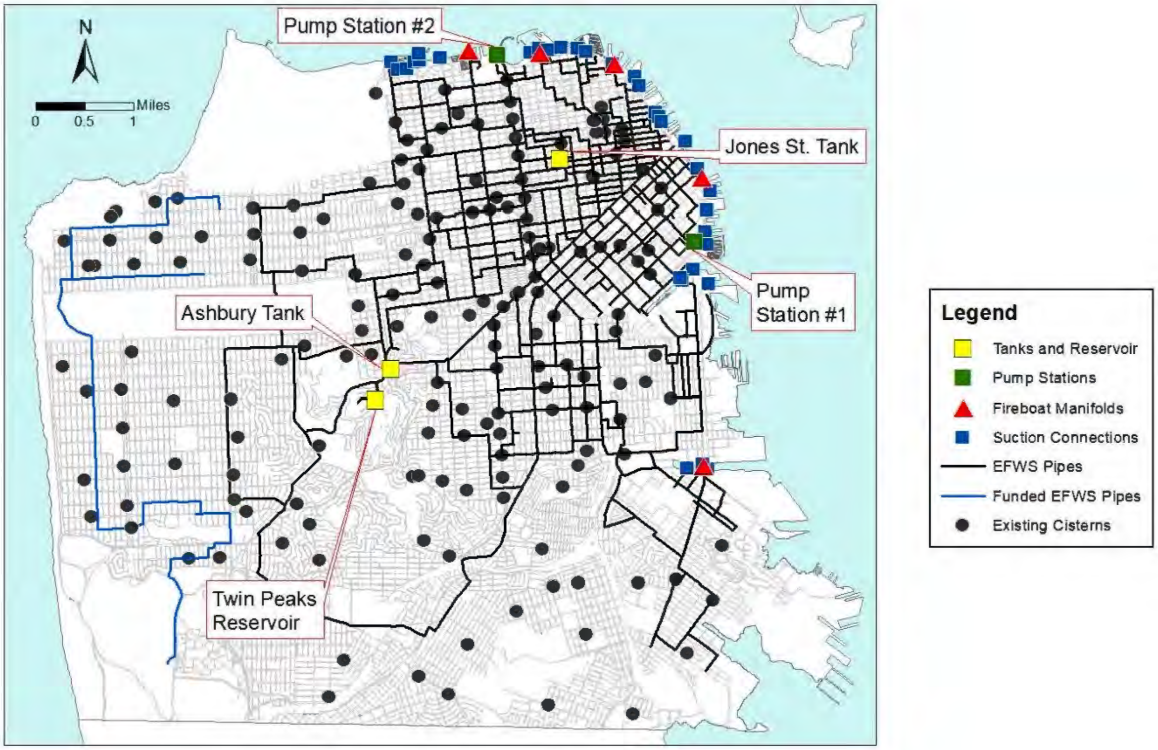


Figure 2-1: EFWS Systems

2.2 PEFWS System

The proposed potable emergency firefighting water system (PEFWS) would supply water by pipeline to the Sunset and Richmond Districts of the city, fed from Lake Merced.

The PEFWS Pipeline Alternatives Analysis Report (AECOM, 2020b) identified the need for new pump stations at Lake Merced and the Sunset Reservoir in order to achieve adequate pressure along the proposed PEFWS pipeline for emergency firefighting, and an acceptable level of system pumping redundancy in case either pump station is out of service. The recommended alternative would provide 30,000 gallons per minute (gpm) of supply with a minimum pressure of 150 pounds per square inch (psi) at all fire hydrants to deliver water to the eight included fire response areas (FRAs).

The PEFWS Pipeline Conceptual Engineering Report (AECOM, 2020c) further refines the PEFWS work performed to date and includes a more detailed assessment of the items related to the pipeline, such as hydrants, valves, and appurtenances.

The Lake Merced Pump Station is currently being planned and designed by the SFPUC and will supply the PEFWS during emergencies from Lake Merced Reservoir in addition to regional potable transmission mains. The Sunset Reservoir Pump Station will be planned and designed in the future and is expected to be constructed when funded. It will provide potable water from Sunset Reservoir and connections from regional potable transmission mains.

Other water supply sources to the PEFWS will be considered separately. The PEFWS Sunset Pump Station Summary Technical Memorandum (AECOM, 2019) contains a compilation of the materials/presentations used to develop the preliminary selection of the pump station site, the development of various mechanical pump alternatives (*e.g.* vertical turbine pumps, horizontal split case pumps), potential building and site concepts, potential connections to Sunset Reservoir and other existing water sources, and a planning-level estimate of probable costs.

The PEFWS will include approximately 47,500 feet of 24-inch earthquake-resistant ductile iron pipe, approximately 15,800 feet of 36-inch welded steel pipe, and approximately 9,500 feet of 42-inch welded steel pipe. The planned facilities associated with PEFWS are shown in Figure 2-2.

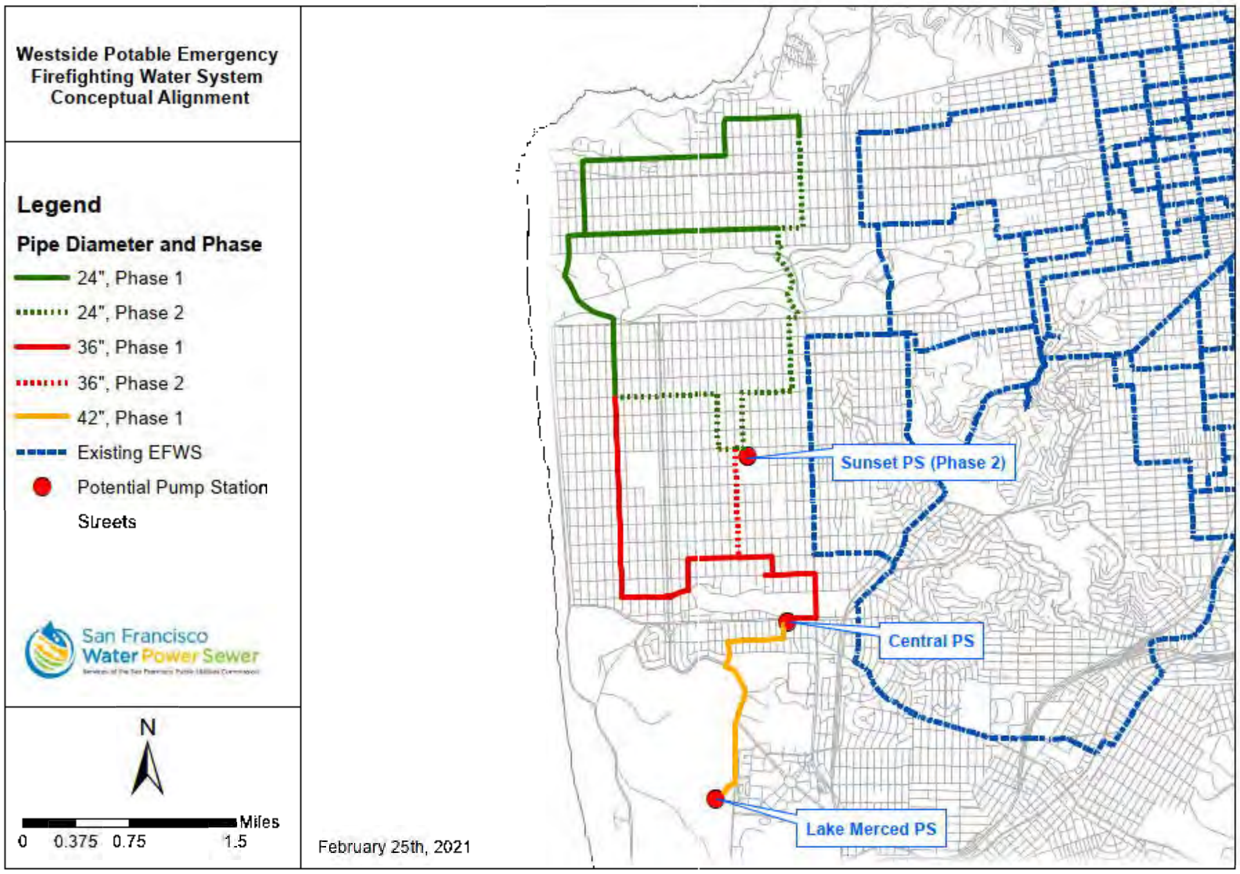


Figure 2-2: Map of PEFWS

2.3 Other Potential Infrastructure

In addition to development of new land-based facilities, it may be possible to adapt or repurpose existing seawater intake infrastructure or use other pump station technologies to support the EFWS.

2.3.1 Repurposing of Retired Potrero Power Station Intake

The Potrero Power Station is a 28+ acre site located in the Central Waterfront District east of the Dogpatch and American Industrial Center and directly fronting San Francisco Bay. For over 150 years (before being decommissioned as a power plant in 2011 by then-owner Mirant Potrero LLC), the site was host to a range of industrial uses from barrel-making and sugar refining to power generation. The site was purchased by Associate Capital/California Barrel Company in 2016, and in 2017 Associate Capital began an extensive planning process to redevelop the property.

In 2020, the City's Planning Commission and Board of Supervisors approved the Development Agreement for Associate Capital to redevelop the area. The proposed project will be a majority residential, mixed-use, and mixed-income neighborhood. It will provide up to approximately 2,600 new housing units, 1.8 million square feet of commercial/retail/hotel space, 7 acres of open space, and off-street parking for approximately 2,700 vehicles. The site is shown in Figure 2-3.

Source: https://sfgov.org/sfplanningarchive/potrero-power-station)

Figure 2-3: Potrero Power Station

The decommissioned power station used a surface water intake structure to draw in a maximum of approximately 226 MGD (157,000 gpm) of seawater from the Bay to cool the condensers in the power generation process. The intake is located near the northeast corner of the site, approximately 250 feet north of the existing outfall structure, which was used to discharge spent cooling water back to the Bay.

Under the new redevelopment plan, a stormwater outfall for discharging runoff from the project site would be installed in the vicinity of the existing intake structure. The current condition of the intake structure, screens, and tunnel are unknown, but as they are original to the plant (mid-1960s), it is assumed that they would need rehabilitation and improvement in order to be to be repurposed for a new seawater pump station in this area.

2.3.2 Floating Pump Stations

In lieu of constructing a fixed, land-based seawater pump station, another possible option is to construct a floating or barge-mounted pump station. Such a pump station would have the capability and added benefit to be relocated to specific locations along a shoreline to areas of the greatest need. Due to the calmer, more protected waters of San Francisco Bay, this type of pump station would be better suited for the eastern side of the city, rather than the Pacific Ocean coastline.

This technology has been around for many decades and is used worldwide in numerous applications and industries. Floating pump stations can be as simple as exposed vertical turbine pumps mounted on a platform floating on pontoons, to a large, fully enclosed facility floating on a barge with separate rooms for the pump equipment, electrical equipment, storage, and even conference rooms or offices, if desired. Pump station capacities can be scaled to cover the range of intake rates under consideration. Photographs of typical floating pump stations are shown in Figure 2-4.

A floating pump station could be self-contained, with diesel- or electric-driven pumps in a single facility. Such an installation could minimize siltation issues such as those experienced it the intakes of the existing Pump Station 1 and Pump Station 2.

Source: CHAMCO *Source: HMS Group*

Figure 2-4: Examples of Floating Pump Stations

To support floating pump stations, permanent walkways extending out from the shoreline with discharge piping mounted underneath would need to be installed at the various selected “docking” locations for the pump station. The discharge piping exiting the pump station would be connected to this permanent discharge piping with flexible connectors to pump seawater into the existing EFWS network in the area.

Figure 2-5: Typical Fireboat Manifold Inlet

Another option is to design a discharge system that can connect directly to the existing fireboat manifolds strategically situated along the bay shoreline. These manifolds allow seawater to be pumped into the existing EFWS network to charge the system and are used by the fireboats for this purpose. There are five such manifolds, the locations of which are shown in Figure 2-1. A photograph of one of these existing manifolds is shown in Figure 2-5. Facilities would also need to be provided to anchor the pump station from horizontal movement while moored at its various locations.

2.3.3 Other Infrastructure and Concepts

There are several other potential water sources to supplement the existing EFWS, as described briefly below. These concepts have not been included in the scope of this pre-feasibility study.

2.3.3.1 Upgrading Existing Seawater Pump Stations

It may be possible to upgrade or retrofit the existing PS1 and PS2 to provide additional capacity to supplement the EFWS. This concept has been previously explored for PS2 (AECOM/AGS, 2013c). For the present study, it is assumed that the existing PS1 and PS2 will remain in their current configurations, and supplemental flows to the EFWS will be provided by new pump stations.

2.3.3.2 Reverse Use of Existing Wastewater Treatment Outfalls

San Francisco has several existing wastewater outfall pipelines, which discharge treated wastewater effluent to either San Francisco Bay or the Pacific Ocean. It may be possible to use these existing outfalls in a “reverse mode” on an emergency basis as intakes to provide seawater to the EFWS. There are numerous technical and regulatory issues associated with this concept; these issues are beyond the scope of the current study.

2.3.3.3 Pumping Seawater to Lake Merced

In lieu of seawater pump stations providing flow directly into the existing EFWS, a seawater pump station could provide supplemental flow to Lake Merced, which would then feed the PEFWS. This concept poses many challenges; the introduction of seawater to Lake Merced would impact both water quality in the lake as well as introduction of seawater into the potable PEFWS system.

2.4 Similar Systems in Other Geographies

In California, several recent and proposed projects incorporate seawater intakes for desalination plants. Other major municipalities around the world have seawater intake systems for various purposes ranging from firefighting (like the EFWS) to toilet flushing. Key organizations with existing or proposed seawater-supplied systems are described below.

2.4.1 Carlsbad Desalination Plant, Carlsbad, CA

The Claude “Bud” Lewis Carlsbad Desalination Plant is the largest seawater desalination plant in the United States and has been in operation since 2015. Located in San Diego County adjacent to the Encina Power Station, the plant delivers nearly 50 million gallons per day (approximately 35,000 gpm) of desalinated water to San Diego County. Owned and operated by Poseidon Water, the plant currently uses the existing seawater intake for the Encina Power Station, which draws once-through cooling water from Agua Hedionda Lagoon via an open water intake. Intake water is screened, used for cooling processes at the Encina Power Station, and a portion of the heated return water is directed to the desalination plant. Poseidon is currently designing and permitting a new state-of-the-art intake system to be constructed when the Encina Power Station is fully decommissioned and demolished.

2.4.2 City of Santa Barbara, CA

The City of Santa Barbara, California has an operating desalination plant with an open water intake. The City’s Charles E. Meyer Desalination Plant draws in approximately 16,000 gpm of seawater and produces 3 million gallons of drinking water per day through reverse osmosis. The intake is not truly “open” to the ocean but has screens with an opening size of one millimeter to prevent entrainment or impingement of marine life, as required by the California Ocean Plan.

(a) Seawater Intake Pipeline

(b) Seawater Intake Screen

https://www.waterboards.ca.gov/santaana//water_issues/programs/Wastewater/Poseidon/2019/Santa_Barbara_Tour_of_Charles_E_Meyer_Desal_Project_Presentation_to_Santa_Ana_Regional_Board.pdf

Figure 2-6: City of Santa Barbara Desalination Plant Intake and Screen

2.4.3 Monterey County, CA

California American Water Company (CalAm) is in the development process of the Monterey Peninsula Water Supply Project (MPWSP) to augment existing drinking water supplies. The MPWSP will include seawater desalination, along with aquifer storage and recovery and groundwater replenishment through wastewater reclamation. The currently proposed desalination component of the overall program will consist of seven subsurface slant intake wells (five active and two standby), a desalination plant, and related facilities.

A pilot slant well was installed and operated between April 2015 and December 2017 to verify viability of the intake concept and collect geologic and hydrologic data. The facilities included the test slant well, a submersible 2,500 gpm, 300 hp submersible well pump, a wellhead vault, electrical facilities and controls, temporary flow measurement and sampling equipment, monitoring wells, and a temporary pipeline connection to the adjacent MRWPCA ocean outfall pipeline for discharges of the test water. The test slant well was drilled at 19 degrees below horizontal, was 685 feet long, and screened for 450 linear feet.

The test well was operated successfully for over two years. CalAm is currently in the environmental review and permitting process with the California Coastal Commission.

2.4.4 South Coast Water District, Long Beach, CA

The South Coast Water District has proposed an ocean desalination project in southern Orange County, California. If developed, the Doheny Ocean Desalination plant would draw water from the Pacific Ocean at Doheny State Beach via slant wells angled under the seafloor, as shown schematically in Figure 2-7. Raw seawater would then be treated at a new reverse osmosis (RO) treatment plant. The use of slant wells was selected (rather than a traditional open seawater intake) as this type of intake prevents marine life from being drawn into the pumps. Several test wells were dug, and a pilot program was operated for several years, with wells producing approximately 2,100 gpm of flow.

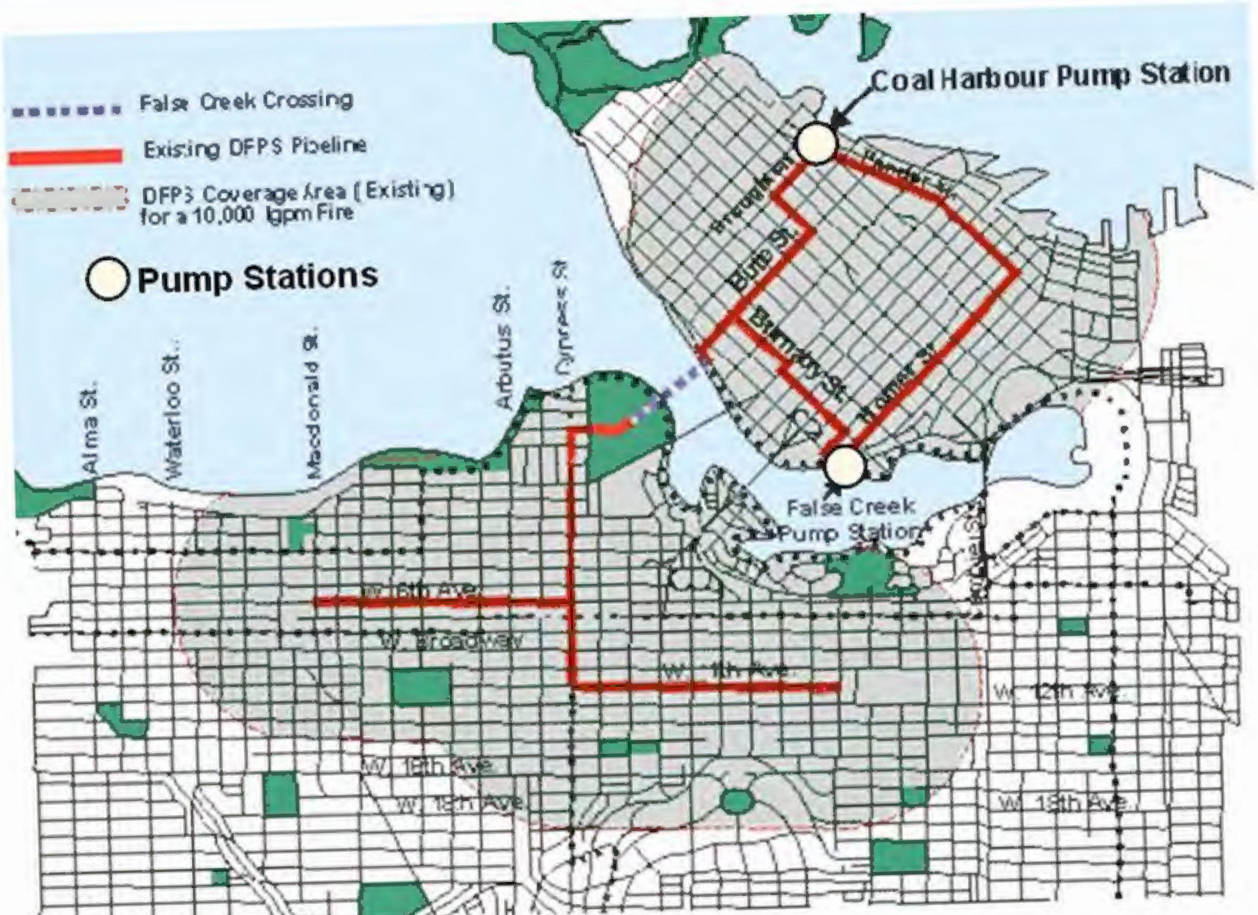
Source: Project Fact Sheet, https://www.scwd.org/civica/filebank/blobdload.asp?BlobID=8168

Figure 2-7: Proposed Doheny Desalination Plant Slant Well Intakes

2.4.5 Vancouver, BC

The dedicated fire protection system (DFPS) in Vancouver, BC, completed in 2003, was constructed as an enhanced secondary fire suppression system for the downtown core, Kitsilano, and Fairview Slopes neighborhoods. This system was modeled after San Francisco's AWSS, and is designed to operate parallel to, and in support of, the regular water main system, which feeds the standard red fire hydrants across the city. In the event of a major earthquake, the DFPS would act as a standalone system, pressurized to 300 psi, and able to withstand the shock of an earthquake measuring approximately 8.3 on the Richter scale.

The DFPS comprises a network of 6.2 miles of 24-inch welded steel underground pipes and forms a wide loop through most of the downtown core, as shown in Figure 2-8. Seven underground valve chambers are located at various critical junctions on the line, each having the capability of sealing off segments of the DFPS in the event of a breach, keeping the remainder of the system operational.



Source: The 1906 San Francisco Earthquake and Fire—Enduring Lessons for Fire Protection and Water Supply, Charles Scawthorn

Figure 2-8: City of Vancouver, BC Dedicated Fire Protection System

Twin pumping stations, located at False Creek and Coal Harbor, are equipped with two Fairbanks Morse vertical turbine pumps. Each pump draws water from a 150,000-gallon storage tank, which is located underneath each pumping station. At full flow, each station can pump 10,000 gpm of water through the DFPS network. Each pumping station is also fully equipped to draw in seawater from the Burrard inlet and False Creek if the wet wells become depleted, or the regular municipally water supply is cut off.

The stations are able to withstand the force of a powerful earthquake and also comes fully equipped with internal power generators and are stocked with enough diesel fuel, equipment and provisions for a crew of six highly trained engineers and operators to last a week in isolation.

2.4.6 Hong Kong, China

Since the late 1950s, Hong Kong has used seawater extensively for toilet flushing. The seawater flushing system is an effective way to conserve fresh water as Hong Kong has never been self-sufficient in fresh water supply. About 80 percent of the population is now provided with seawater for toilet flushing. The water is pumped from 42 treatment plants on the coast through a network of pipes carrying water to businesses and residences solely for toilet flushing. Using seawater for this purpose reduces the city's freshwater consumption by 20 percent.

The risk of corrosion of the pipes is reduced through use of cement lined iron pipes for the main distribution network and polyethylene (HDPE) pipes for in-building services. Duplex stainless steel is used for the pumps. These measures have increased the average life expectancy of pipes in the network before renewal may be necessary.

At one of the treatment plants in Wan Chai, four large pumps withdraw water from the sea, as shown in the photograph in Figure 2-9. The water passes through mesh gates that filter out aquatic organisms, floating plastics, and other debris. The seawater is then then treated through electro-chlorination, where an electric current is passed through the seawater, triggering a reaction that produces hypochlorite. This process not only disinfects the water but also reduces odor.

Figure 2-9: Pumps at Wan Chai Seawater Treatment Facility Supply Toilet Flushing Water

Chapter 3: Supply and Demand Evaluation

This chapter reviews the available existing water supply sources for the EFWS, as well as the potential flow requirements needed from new seawater supplies to the EFWS system.

3.1 Existing Supply Sources

To fight fires after an earthquake, water must be supplied at a sufficient flow rate and pressure and for an adequate duration to meet estimated post-earthquake fire demand. Water flow and pressure is provided by infrastructure such as pipelines, pump stations and storage facilities by way of their elevation. The volume of storage facilities, such as reservoirs and large bodies of water (such as San Francisco Bay), also govern the duration for which firefighting supplies can be maintained.

Cisterns and fireboats will likely be required in the initial hours after an earthquake but take time to mobilize to an active status. The existing seawater Pump Station 1 can be started remotely, but requires personnel to initiate, and Pump Station 2 at present has no remote capability.

The Emergency Firefighting Water System Supply Analysis Technical Memorandum (AECOM, 2020a) analyzed and examined the storage volume available for fighting fires on a city-wide basis at the present time.

3.2 Seawater Pump Station Demands

Although the existing and currently planned PEFWS supply sources can likely meet the immediate post-earthquake fire demands throughout much of San Francisco, water storage within the city will be severely impacted. For example, under some modeled scenarios, the Twin Peaks Reservoir (currently the primary EFWS storage facility) may not be able to supply flow beyond 6 hours. Within three days, most of the potable reservoirs may reach a low level where they are no longer available for fire fighting. Only Lake Merced, with its nearly 2 billion gallons of capacity, can maintain a significant storage over the 5-day period (AECOM, 2020a).

Supplemental water sources can meet not only firefighting demands, but also reduce the impact on the potable reservoirs. Supplemental sources include other potable reservoirs such as Merced Manor, Stanford Heights, and College Hill Reservoirs as well as nonpotable sources such as Lake Merced or new seawater pump stations.

The maximum amount of supply deficit at present is estimated to be on the order of 40,000 gpm, but future growth in the City may increase demands. A separate analysis is currently being conducted to evaluate overall EFWS needs for the future (AECOM, 2021).

Different configurations of the new seawater pump stations are discussed herein, ranging from 3,000 gpm to 50,000 gpm. This range of flows was selected to provide a broad view of potential additions of seawater to the EFWS.

Chapter 4: Regulatory Considerations

This chapter reviews the various regulatory jurisdictions and authorizations that may be required for development of new seawater supplies to the EFWS system.

4.1 Overview

Proposed actions to enhance and expand existing firefighting water supply with an EFWS will require the installation, testing, operation, and maintenance of new facilities and infrastructure. Preferred and alternative actions developed and proposed to meet the purpose and need for enhancing the firefighting water supply will require review and input from the public, state and federally mandated environmental review, and various permits, authorizations and leases from regulatory agencies and other key stakeholders.

One avenue for public review of project alternatives would occur during the environmental review processes established under the California Environmental Quality Act (CEQA) and, for any direct federal involvement or funding, under the National Environmental Policy Act (NEPA). With certification of a final CEQA document and a decision document signed by a federal acting agency under NEPA, there remains a considerable permit acquisition phase prior to project implementation.

At the present pre-feasibility assessment stage, this chapter describes the need for CEQA and NEPA documentation, public involvement as part of the acting agency decision-making process, and, moreover, the range of regulatory jurisdictions and processes that may be necessary under various conditions.

While a range of project implementation strategies envisaged are in an early stage of development, any one method for expanding and enhancing the existing EFWS would have an impact upon several managed man-made and natural resources within and adjacent to the city of San Francisco. New or expanded seawater extraction infrastructure, associated pumping stations and a distribution pipeline system will involve a plethora of federal, state, regional and local regulatory jurisdictions and stakeholders. These entities will be keenly interested in the process used by the SFPUC to identify preferred action and alternative actions prior to issuing permits affecting managed resources.

Below is an overview of anticipated environmental review and regulatory permits and leases that should be considered when establishing preferred and alternative actions. This analysis should be further developed as a set of identified alternatives so that specific actions can be considered from a regulatory perspective.

4.2 Project Design Development and Alternatives Analysis

It is critical to understand the regulatory framework and policies that impinge upon a proposed project early in the development of the hierarchy of alternatives. Design considerations may be substantially influenced by a regulatory agency's policies that govern the type and location of facilities and infrastructure that may be required to meet a project's purpose and need. When consulted early and thoroughly considered, such an understanding with these entities can lead to synergies and co-benefits with overall agency efforts and public policy goals, particularly at the local level. Such inclusion of environmental regulatory considerations early in the project development and site-selection process is instrumental in streamlining the impending environmental review processes under NEPA and CEQA, as well as subsequent permit acquisition efforts.

4.3 NEPA/CEQA Process

Federally funded actions or those requiring a federal permit will typically trigger the need for NEPA review and documentation by a lead federal agency per Council on Environmental Quality regulations at 40 Code of Federal Regulations (CFR) Parts 1500–1508. Should new access to seawater from the Pacific Ocean be proposed, intake infrastructure within waters of the U.S. adjacent to the city of San Francisco would require permits from the U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and potentially the National Park Service (NPS) or the U.S. Coast Guard (USCG), if the footprint crosses NPS land or triggers a change in markings on navigational charts, respectively. For near- and on-shore actions within federally managed lands such as broad areas of the Golden Gate National Recreation Area (GGNRA), the NPS would be the likely lead federal agency requiring review under NEPA. The NPS GGNRA is present along most of the coastal areas on the Pacific Ocean side of the city. NPS NEPA policy is found at https://www.nps.gov/subjects/nepa/policy.htm.

Other federal agencies may be affected, but at a lower degree of potential impact (*i.e.,* crossing a federal interstate highway or federally owned land parcel). Depending on the level of potential impacts to federally managed resources, the NEPA process may require the preparation of an environmental impact statement (EIS), an environmental assessment (EA) or, for simple actions commonly occurring and authorized by the federal agency, a categorical exclusion may be warranted (*i.e.*, a simple pipeline crossing a previously disturbed area). In general, an EIS may take 3 to 5 years to complete, an EA about 2 years, and a categorical exclusion in much less time, if allowed.

Similarly, for a City-proposed EFWS project of this scope and magnitude, a CEQA analysis and associated public review would be required before finalizing a decision to proceed per Public Resources Code 21000–21189 and the CEQA Guidelines at California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000–15387), available from http://leginfo.ca.gov/ and http://ccr.oal.ca.gov/. The anticipated scope of the EFWS project points to the likely need for an environmental impact report (EIR) under CEQA. The range of environmental topics analyzed under CEQA and the criteria used to determine impact significance differs from that under NEPA, but the preparation time is on par with an EIS. In some cases, these parallel evaluations can be more efficiently prepared under a joint CEQA/NEPA document. This is particularly advantageous when each lead agency is clear about and well aligned with each other's environmental review priorities and schedule.

4.4 Potentially Affected Regulatory Agencies and Jurisdictions

During and following the NEPA/CEQA process, a host of permits and authorizations will be required from regulatory agencies. The likely affected agencies, depending on the affected state waters, shoreline, and upland areas affected, are described below. They involve federal, state, regional and local resource management and planning agencies responsible for the use of air, water and terrestrial resources, urban planning areas and transportation corridors. Numerous regulatory agencies have overlapping or related responsibilities, particularly in areas near the convergence of ocean and estuarine waters of San Francisco. Certain responsibilities are clearly separated by whether they involve ocean or bay resources, such as the California Coastal Commission (CCC) along the ocean and the Bay Conservation and Development Commission (BCDC) along the bay.

the review of ocean and bay shoreline opportunities for potential expansion of the EFWS, and associated regulatory responsibilities, have been segmented into five subregions based on geologic, regulatory and land use influences (see Figure 4-1 and Figure 4-2). These subregions include:

- Ocean Southern Dunes: Longshore sandy beaches south of Sutro Heights (Balboa Street) and southward to the city limits.
- Ocean Rocky Area South: Beaches and headlands south of the Presidio to the south end of Sutro Heights.
- Ocean Rocky Area North: Headlands fronting the Presidio west of the Golden Gate Bridge.
- SF Bay Area North Bayfront: The bay shoreline from the Golden Gate Bridge to the Bay Bridge.
- SF Bay Area East Bayfront: The bay shoreline from the Bay Bridge south to the city limits.

Table 4-1: Primary Shoreline Regulatory Jurisdictions

<table>
<tr><th>Study Subregion</th><th>Intake</th><th>Pump Station</th><th>Pipelines</th><th>Discharge</th><th>Flushing</th></tr>
<tr><td>Ocean/Rocky Area North</td><td rowspan="3">California Coastal Commission

and

National Park Service</td><td colspan="2">Presidio Trust</td><td colspan="2" rowspan="3">California Coastal Commission</td></tr>
<tr><td>Ocean/Rocky Area South</td><td colspan="2" rowspan="2">National Park Service

City of San Francisco
(Local Coastal Program)</td></tr>
<tr><td>Ocean/Southern Dunes</td></tr>
<tr><td>SF Bay/North Bayfront</td><td colspan="5" rowspan="2">San Francisco Bay Conservation and Development Commission</td></tr>
<tr><td>SF Bay/East Bayfront</td></tr>
</table>

From a regulatory compliance perspective, each of the project components are defined as follows:

- Intake System: Subsurface intake wells or infiltration galleries or screened open-water intake pipeline systems that are positioned below the mean high water (MHW) elevation.
- Pump Station: Typically consist of fossil fuel-powered water pumping systems housed in a shelter or enclosure and located upland of the MHW and within proximity to its water source.
- Pipelines: These represent pipelines needed for a variety of uses, including conveyance between the source water and a pump station with high-pressure circulation within the city, and pipelines dedicated to the discharge of seawater to open water or sewer systems following testing and/or freshwater flushing.
- Discharge: The point of release of seawater from a discharge pipeline other point source into a water body or other receiving area.
- Flushing: The point of release of freshwater that has been used for flushing pipelines and pump stations following testing with seawater into a water body or receiving area.

4.4.1 Potentially Affected Primary Shoreline Regulatory Jurisdictions

To more readily depict and describe potentially affected regulatory agencies with jurisdiction for areas where project components would occur along or near the shoreline within each subregion, a set of primary shoreline regulatory jurisdictions have been identified in Table 4-1. Primary shoreline jurisdictions are agencies that typically have final regulatory approval authority and frequently require all other permits to have been obtained prior to receiving their approval. These primary shoreline jurisdictions are shown geographically on the map provided in Figure 4-1.

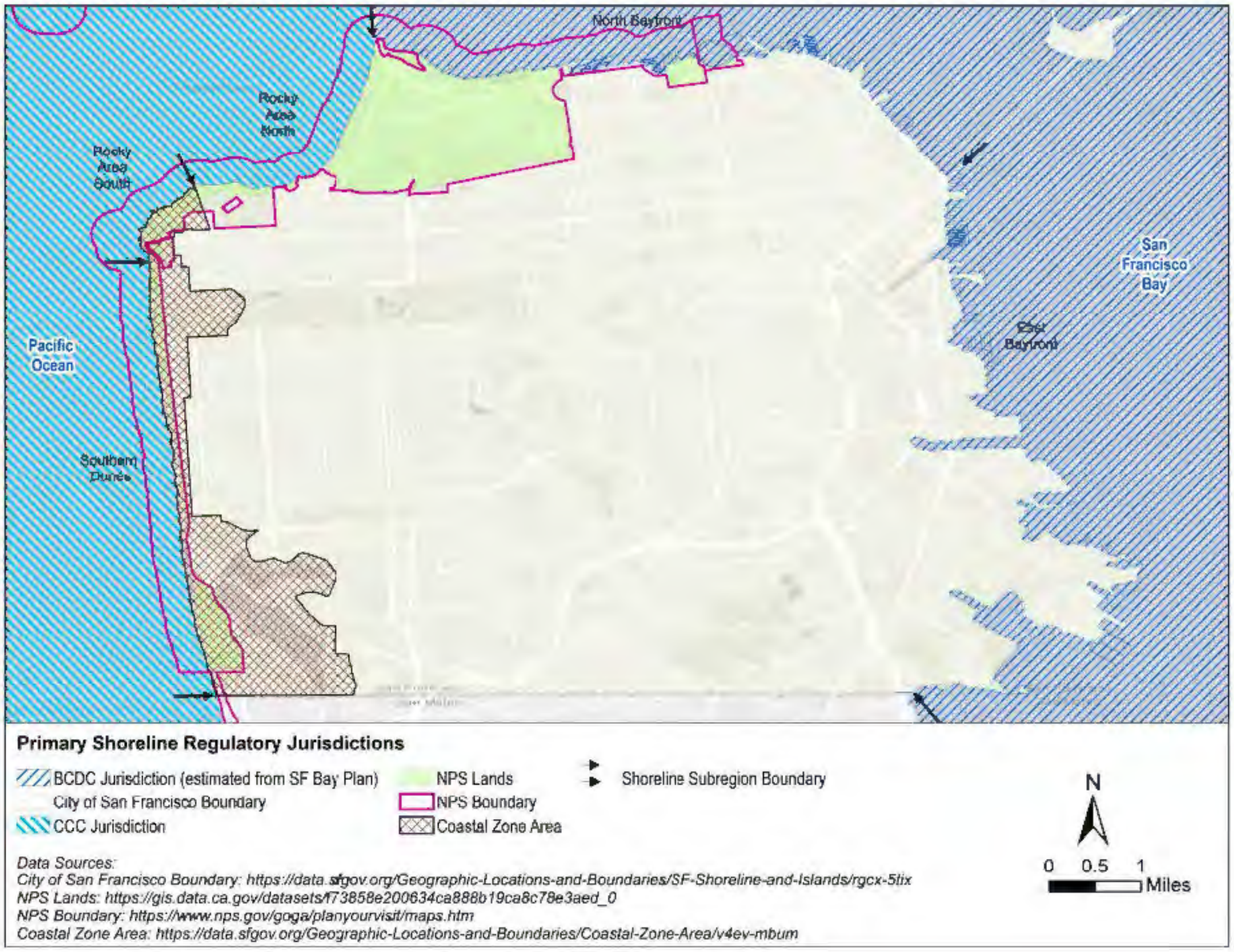


Figure 4-1: Primary Shoreline Jurisdictions

4.4.2 Potentially Affected Secondary Shoreline Regulatory Jurisdictions

Other affected regulatory agencies occur at or near the shoreline within each subregion. Secondary Shoreline Regulatory Jurisdictions are those that have responsibility for resources and lands (submerged and upland) for which a permit, authorization or lease would be required. These agencies are identified by subregion in Table 4-2 and are shown geographically on the map provided in Figure 4-2.

Table 4-2: Secondary Shoreline Regulatory Jurisdictions

<table>
<tr><th>Study Subregion</th><th>Intake</th><th>Pump Station</th><th>Pipelines</th><th>Discharge</th><th>Flushing</th></tr>
<tr><td>Ocean/Rocky Area North</td><td rowspan="5">State Lands Commission
Regional Water Quality Control Board
U.S. Army Corps of Engineers
California Dept of Fish and Wildlife
National Marine Fisheries Service
U.S. Coast Guard</td><td>--</td><td>--</td><td colspan="2" rowspan="5">State Lands Commission
Regional Water Quality Control Board
U.S. Army Corps of Engineers
U.S. Coast Guard</td></tr>
<tr><td>Ocean/Rocky Area South</td><td>--</td><td>--</td></tr>
<tr><td>Ocean/Souther n Dunes</td><td>--</td><td>--</td></tr>
<tr><td>SF Bay/North Bayfront</td><td colspan="2" rowspan="2">Port of San Francisco</td></tr>
<tr><td>SF Bay/East Bayfront</td></tr>
</table>

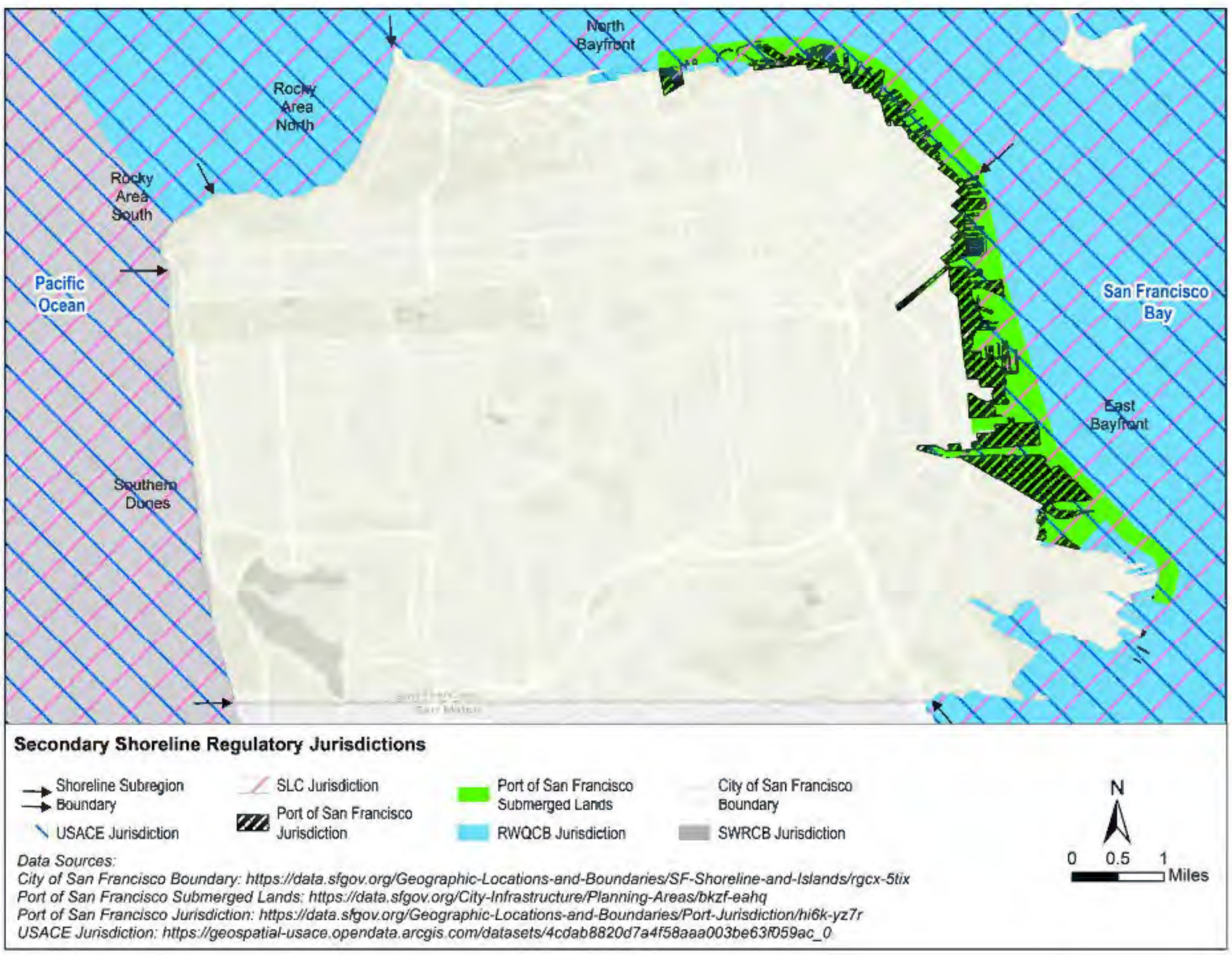


Figure 4-2: Secondary Shoreline Regulatory Jurisdictions

4.4.3 Other Potentially Affected City Interior Regulatory Jurisdictions

In addition to the agencies and jurisdictions discussed above, other regulatory agency jurisdictions that may occur upland of the shoreline and within the city interior are identified below. This may not be an exhaustive or exclusive list; however, the typical regulatory jurisdictions potentially affected within the city interior are tentatively identified in Table 4-3.

Table 4-3: Other Potentially Affected City Interior Regulatory Jurisdictions

<table>
<tr><th>Study Subregion</th><th>Intake</th><th>Pump Station</th><th>Pipelines</th><th>Discharge</th><th>Flushing</th></tr>
<tr><td>Ocean/Rocky Area North</td><td rowspan="5">Not Applicable</td><td colspan="2" rowspan="5">Presidio Trust (Rocky Area North)
National Parks Service (ocean subregions)
City Planning Department (planning areas)
California Department of Transportation
Regional Transit Agencies
California Department of Fish and Wildlife
U. S. Fish and Wildlife Service
U.S. Army Corps of Engineers
Region 2 Water Quality Control Board
California State Parks (East Bayfront)</td><td colspan="2" rowspan="5">Not Applicable</td></tr>
<tr><td>Ocean/Rocky Area South</td></tr>
<tr><td>Ocean/Southern Dunes</td></tr>
<tr><td>SF Bay/North Bayfront</td></tr>
<tr><td>SF Bay/East Bayfront</td></tr>
</table>

Regulatory jurisdictions that extend from the near-shore area into the interior of the city include various city departments, including planning and transportation agencies, city parks, and various historic districts. Permits or exemptions from permits may be required from these various local departments, in addition to federal, state, and regional entities mentioned above. Also present are rights-of-way for regional, state, and federal highway, train, transit, and rail corridors. Perpendicular and longitudinal encroachment crossings of these rights-of-way require a detailed application expressing the need, purpose, function, design and maintenance of utility infrastructure or other proposed elements for which an encroachment permit is requested. A high-level representation of San Francisco planning zones is depicted in Appendix A. More fine-scale data for each individual area is available and should be reviewed as alternative sites are considered.

4.5 Regulatory Jurisdiction Details

This section provides greater insight into each of the potentially affected regulatory entities that may be involved with implementing the EFWS, depending on the siting alternatives ultimately considered. A general assessment for this level of analysis has been provided regarding the overall level of time, expense and challenging requirements that would likely be encountered with each entity. These levels of difficulty are generally defined as follows:

- **High**: Requires substantial time and expense to coordinate with regulatory staff and decision-makers, preparing advance special studies and engineering documentation for review, and encounters substantial public scrutiny and appeals processes that may extend the time required for approval. Review and approval time are typically 24 to 36 months even under ideal conditions.
- **Moderate**: Requires modest amounts of time and expense to coordinate with regulatory staff and decision-makers, with the need for highly predictable advance special studies and engineering documentation and has a well-defined application review structure and timeline. Review and approval time are typically 12 to 24 months.

- **Low**: Requires minimal amounts of time and expense to coordinate with regulatory staff relative to other entities, with very limited to no preparation of advance special studies required, and their approval process is largely independent of decisions by other regulatory entities. Review and approval time are typically less than 12 months.

Note that several of these entities are procedurally or statutorily intertwined with another reviewing entity's decision, requiring one approval in order to obtain final authorization under a more consequential approval (*e.g.*, a Water Quality Certification from the RWQCB in order to obtain final authorization of a USACE Individual Permit under the Clean Water Act).

4.5.1 Federal Jurisdictions

4.5.1.1 National Park Service

The NPS, within the US Department of Interior, has jurisdiction of portions of the coastline under the 1972 Golden Gate National Recreation Enabling Act (H.R. 16444) and under Title 16 U.S. Code Subchapter LXXXVI, GGNRA. The GGNRA is defined as the lands within the defined federal boundaries, waters, and submerged lands extending 1/4 mile offshore from the coastal enclaves (Figure 4-1). The Enabling Act defines the area to "provide for recreation and educational opportunities consistent with sound principles of land use planning and management. In carrying out the provisions of this subchapter, the secretary shall preserve the recreation area, as far as possible, in its natural setting, and protect it from development and uses which would destroy the scenic beauty and natural character of the area" (H.R.16444).

From our experience, the NPS would be a lead federal agency under NEPA for any substantive infrastructure within its jurisdiction, both immediately offshore and onshore. An encroachment permit and construction permit would be required from NPS for work within GGNRA. GGNRA, collectively, is also considered a National Historic Landmark and habitat for federal and state listed species protected under NEPA, CEQA, and other subsequent natural resource regulations. In addition, the following Memoranda of Understanding exist between the NPS and others that may become relevant to the EFWS depending on siting alternatives ultimately under consideration.

Memoranda of Understanding

- *Fort Mason and the Presidio were formerly owned by the US Army. NPS has an MOU with the US Army (1972) that outlines joint usage of Fort Mason as a sub-installation of the Presidio (nps.gov). A portion of the Presidio is managed by The Presidio Trust, described below.*
- *Areas of the GGNRA including Fort Funston, Ocean Beach, and Lands End were formerly owned by the City and County of San Francisco (CCSF). A MOU between CCSF and NPS (1975) requires the General Superintendent of the GGNRA to formally notify and consult City Planning on all proposed construction plans (sfdog.gov). The MOU includes a provision for public access that states transferred CCSF-owned park lands were to be reserved by the NPS "to hold only for so long as said real property is reserved and used for recreation and park purposes."*
- *The City's Fire Department has an MOU with the NPS that states the Department responds to areas they own within GGNRA (sf-fire.org)*

The NPS has a well-established NEPA implementation process that would tend to streamline project review under that federal policy; however, leases or encroachment permits may take considerable time under federal transfer procedures. The coordination and approval efforts with NEPA are characterized as moderate.

4.5.1.2 The Presidio Trust

The Presidio of San Francisco is managed by two federal agencies in partnership; 300 acres along the coast are managed by the National Park Service (see below), while the rest of the Presidio (1,191 acres) is managed by the Presidio Trust. Both federal agencies work in close collaboration with the Golden Gate National Parks Conservancy, a nonprofit organization that provides indispensable philanthropic and programmatic support.

The Presidio Trust is an unusual federal agency founded under the Presidio Trust Act and charged with operating the park without taxpayer support. Funds earned through leasing homes and workspaces and operating hotels, a golf course, and venues are used for park management and upkeep.

The Trust and its partners have converted the former military post into an inviting national park site wet within an urban area. The Presidio is home to a large community of residents and tenants, and offers recreation, hospitality, and educational opportunities to people throughout the Bay Area and beyond.

Under the provisions of the Presidio Trust Act, six members of the Presidio Trust Board are appointed by the President of the United States. The seventh member, currently Todd Willens, is the U.S. Secretary of the Interior or his/her designee. The Board acts only as a body, taking actions by vote. All the actions of the Trust Board are reported publicly by publishing the minutes of each meeting. As a public safety project, the coordination effort and timing are expected to be moderate.

4.5.1.3 US Army Corps of Engineers

Under Section 404 of the federal Clean Water Act (1972, amended in 1987) (CWA), Section 10 of the Rivers and Harbors Act (1899), and the Navigable Waters Protection Rule (2020), the USACE issues Standard Permits and General Permits. Standard Permits include Individual Permits and Letters of Permission. General Permits include Nationwide Permits and Regional Permits. Each permit requires a different NEPA process, agency coordination, public notification, and preparation of information depending on the project’s overall impacts and level of complexity.

All work in or touching navigable waters, wetlands, streams, lakes, ponds, and other jurisdictional Waters of the US require consultation with USACE. Prior to submitting a permit application, applicants are encouraged to prepare and submit a Jurisdictional Determination Report. This report provides descriptions and mapping to identify the limits of a project site, in additional to the limits of jurisdictional waters of the US. Notification to National Marine Fisheries Service and/or USFWS for endangered species consultation and to the State Historic Preservation Office (SHPO) for cultural and historic resource considerations are made by the Corps as part of the Section 404 application process.

Early collaboration with the USACE prior to submittal of permit applications under Section 404 of the CWA has been a valuable means of integrating key elements into the design and required alternatives analysis for minimizing overall fill and associated impacts to natural resources. USACE permit review guidance is provided in Appendix B. The USACE review is well regimented yet dependent upon approvals from NMFS, USFWS, SHPO and RWQCB and is thereby expected to have a moderate level of difficulty for this type of initiative.

4.5.1.4 National Marine Fisheries Service

NMFS, within the National Oceanic and Atmospheric Administration, has jurisdiction of most marine biological resources, including species habitat under Section 7 of the Endangered Species Act (ESA) and under the Magnuson Steven Fisheries Conservation and Management Act (MSA). Consultation with the NMFS under Section 7 of the ESA would be required for proposed actions within ocean or bay waters adjacent to the city of San Francisco and in affected freshwater streams supporting anadromous fish and other protected species.

Under the ESA, certain species also have designated Critical Habitat, defined as areas of habitat believed to be essential to the species' conservation (see Appendix A). Actions in designated Critical Habitat must not destroy or adversely modify that habitat. Similarly, under the ESA, some protected fish species also have established Essential Fish Habitat (EFH), defined as includes reefs, kelp forests, bays, wetlands, rivers, and ocean that are necessary for fish reproduction, growth, feeding, and shelter. EFH requires identification and guidelines for fisheries management for the conservation of species with Regional Fishery Management Councils (Councils) and the Secretary of Commerce in fishery management plans. The regulations require consultations on actions that may adversely affect EFH.

Areas of mapped eelgrass in the bay are additionally protected under NMFS's California Eelgrass Mitigation Policy (2014) and the State's "Strategic Plan to Protect California's Coast and Ocean 2020 – 2025" (see Appendix A). Eel grass ecosystems are recognized as critical habitat for many marine species and are threatened from urban development and pollution. Section 3.1.4 of the state's document directs the California Ocean Protection Council (advisory council to the California Coastal Commission) to "work with partners to preserve the existing, known 15,000 acres of seagrass beds and create an additional 1,000 acres by 2025 by supporting projects that protect existing and potential eelgrass habitats as identified in habitat suitability mapping, consistent with the California Eelgrass Mitigation Policy."

The Federal Marine Mammal Protection Act of 1972 (MMPA) protects all marine mammals, despite the species status under the ESA. The MMPA requires work in marine waters to apply for an Incidental Harassment Authorization (IHA) from the NMFS Office of Protected Resources (NMFSOPR). A select few species protected under the MMPA that may occur in San Francisco waters are under USFWS jurisdiction; however, permit applications would still be processed through NMFSOPR. A third federal agency, the Marine Mammal Commission, reviews and make recommendations on the policies and actions of the Service and NMFS related to their implementation of the MMPA.

Consultation with NMFS will be required to determine a complete list of protected species and habitat that have potential to occur as alternative sites are identified. Evaluating the potential to affect EFH and marine mammals prior to final siting and/or design of take and discharge elements have been shown to streamline NMFS review time under Section 7 of the ESA and promote issuance of a letter of no adverse effect to the extent possible. When carefully sited within marine environments, this project would be expected to encounter a moderate level of difficulty in obtaining NMFS authorization.

4.5.1.5 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) shares jurisdiction and Section 7 ESA consultation with the NMFS. USFWS jurisdiction covers all terrestrial and freshwater aquatic species, as well as terrestrial critical habitat (see Appendix A). One of the few marine mammal species under the jurisdiction of USFWS, pursuant to the MMPA, that may occur in San Francisco waters is the Southern sea otter *(Enhydra lutris)*.

USFWS also reviews and comments on National Wildlife Refuges (NWR) and State Habitat Conservation Plans (HCP) to minimize impacts on fish and wildlife species and their habitats. There are no NWR or HCPs in CCSF; however, it is likely that many wildlife species that occur within CCSF are shared populations from nearby NWR throughout San Francisco Bay and on the Farallon Islands offshore of Ocean Beach, as well as from nearby Habitat Conservation Plans in San Mateo County and the East Bay.

Similarly, consultation with USFWS will be required to determine a complete list of protected species and habitat that have potential to occur as alternative sites are identified. Early coordination with the USFWS's purview under Section 7 of the ESA to review efforts to avoid or minimized potential effects to federally protected species and document these conditions in a Biological Assessment has streamlined USFWS review time and their issuance of a favorable Biological Opinion. The type and amount of potentially affected species under USFWS review would tend to be relatively easy to avoid or mitigate in an urban setting. The relative level of difficulty in completing coordination with the USFWS is considered low.

4.5.1.6 U.S. Coast Guard

US Coast Guard authority for structures installed in or over navigable waters is provided in Code of Federal Regulations Title 33, Navigation and Navigable Waters. Chapter I – Coast Guard, Department of Homeland Security, Subchapter C, Aids to Navigation, Part 64, Marking of Structures, Sunken Vessels and other Obstructions, Subpart C—Structures, § 64.21, Marking and notification requirement. In general, it states that before establishing a submerged or overhead structure in or over waters of the US, the owner or operator shall apply for a Coast Guard review to determine if the proposed structure poses a hazard to navigation and to obtain authorization to install and mark the structure. The appropriate USCG District Commander will determine whether there is a hazard to maritime navigation and, if appropriate, the obstruction marking requirements.

4.5.2 State Jurisdictions

4.5.2.1 California Coastal Commission (CCC)

The California Coastal Commission (CCC), in partnership with coastal cities and counties regulates the use of land and water in the designated coastal zone, and is responsible for implementing coastal zone planning and management under both the State of California Coastal Act of 1976 and under the Federal Coastal Zone Management Act of 1972 (Title 16 US Code 1451). The CCC coastal zone is generally defined as extending seaward to the state's outer limit of jurisdiction, including all offshore islands, and extending inland generally 1,000 yards from the mean high tide line (databasin.org) (Figure 4-1).

Development activities generally require a Coastal Development Permit from either the California Coastal Commission or from the City of San Francisco under its CCC-approved Local Coastal Plan (LCP) (see further discussion of the City's LCP below). Upon review and acceptance of a completed CDP application and CCC staff review, a public hearing is required if a proposed project is within the CCC's appealable subarea of a LCP (see Figure 4-1) or if the Zoning Administrator determines that the project has a significant impact on the Coastal Zone (coastal.ca.gov).

The coastal zone regulated by the CCC does not include the area of jurisdiction attained by the San Francisco BCDC. The BCDC was created prior to the CCC and established pursuant to Title 7.2 (commencing with Section 66600) of the Government Code. However, the CCC can comment on a project within BCDC jurisdiction if the project may impact resources that fall within either BCDC, CCC jurisdiction (Section 30330 CA Coastal Act). For proposed actions within its jurisdiction, in this case within Pacific Ocean subregions, the CCC will typically be the final approval obtained from a state regulatory agency.

It is advantageous to engage senior CCC staff regarding the identification of seawater intake site alternatives, including coordination with technical consultants with an understanding of intake engineering and screening technologies, environmentally sensitive habitat areas, and discharge dispersal and construction techniques. That said, the CCC's opinion and final decision can be difficult to predict, as external factors can emerge late in the review process that may result in further studies, mitigation efforts or renewed public outreach. The level of difficulty for coordination and review time prior to approval of a Coastal Development Permit is considered high.

4.5.2.2 San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) regulates all fill and coastline development in the San Francisco Bay basin under the California State McAteer-Petris Act (1965). In August 1969, the McAteer-Petris Act was amended to make BCDC a permanent agency and to incorporate the policies of the San Francisco Bay Plan (Bay Plan) into state law. BCDC Jurisdiction includes all bay waters east of the Golden Gate Bridge including creeks, rivers, sloughs, tributaries, marshes, mudflats, salt ponds, and other wetlands. BCDC's jurisdiction extends to the mean high tide line in areas that do not contain tidal marsh and up to five feet above mean sea level in areas of tidal marsh, as well as upland to 100 feet from the shoreline (Figure 4-1).

Land use practices that have the potential to impact water quality, to change the shoreline (including public access), and the protection of coastal resources are handled by BCDC or CCC, depending on geographic region of the SF Peninsula. Any project that touches San Francisco Bay or touches any point along the bay shoreline requires a BCDC permit. BCDC's jurisdiction does not overlap with the CCC; however, as mentioned above the agencies may comment on projects that may impact resources that fall within the other's jurisdiction (see CCC description above).

BCDC's regulatory document, the Bay Plan states that regulatory authority for water quality remains with the RWQCB, EPA, and USACE; however, the Bay Plan implements measures to support and promote the Basin Plan to maintain sufficiently high water quality levels for beneficial water use in the bay, including recreation and healthy aquatic habitats. Pages 84 through 86 of the Bay Plan discuss policy for water intake, circulation, and drainage as it pertains to managed Wetlands, salt ponds, and desalination.

BCDC also published the document titled Desalination and the San Francisco Bay. Chapter 2 discusses seawater intake systems for the bay. It states that open, surface intake systems may be on the bay bottom or suspended from a structure built over the water (*i.e.,* a pier). Subsurface intakes systems do not work well due to a lack of granular material underlying the bay or on its shoreline, consequently these systems are not part of intakes for facilities such as desalination plans or other purposes.

The BCDC has demonstrated a keen understanding of appropriate seawater intake methods and technologies that support project goals and protect submerged bay bottom resources. Their review of prior desalination plant and other intake proposals have led to a relatively successful path forward and a more predictable level of scrutiny. Depending on the size and location of infrastructure within the bay, the level of difficulty for coordination and review time prior to a final BCDC authorization is considered moderate to high.

4.5.2.3 State Water Resources Control Board

The State Water Resources Control Board (SWRCB) has jurisdiction and responsibility under the federal Porter-Cologne Act, federal CWA, and California Water Code Section 13170 for water quality control in all Waters of the United States. The SWRCB is divided into geographic regions of the state, and each regional Water Board takes jurisdiction of the state. Regional waters of the San Francisco Bay Basin, including tributaries, drainages, and some coastal waters are part of Region 2 (RWQCB). The RWQCB works cooperatively with both CCC and BCDC to establish and implement water quality objectives.

CCC and SWRCB Ocean Standards

The SWRCB has established Ocean standards to protect the beneficial uses of California's marine waters, primarily through the establishment of water quality objectives and implementing provisions in statewide water quality control plans and polices. Ocean standards plans and policies include the Water Quality Control Plan for Ocean Waters of California (Ocean Plan), the Water Quality Control Plan for

Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (California Thermal Plan), and the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Once-Through Cooling Policy).

The Ocean Plan is one of five statewide water quality control plans established by the SWRCB to preserve and enhance California's territorial ocean waters for the use and enjoyment of the public. This is achieved by controlling the discharge of waste into the ocean and seawater intake. Discharge of waste can include stormwater runoff, municipally treated sewage outflow, and other discharges by industry under regional and state board permits. The Ocean Plan, adopted by the SWRCB on July 6, 1972, has been amended five times since it was last reviewed in 2011. The amendments are as follows:

- Model Monitoring, Vessel Discharges, and Non-Substantive Amendment (2012): Guidance for monitoring ocean waters, aligned provisions with state and federal laws and regulations for commercial vessel discharges, and applied various formatting and grammatical changes.
- State Water Quality Protection Areas and Marine Protected Areas Amendment (2012): Established new criteria for designating State Water Quality Protection Areas.
- Trash Amendment (2015): Provisions to control trash entering California's ocean waters.
- Desalination Amendment (2015): Requirements to protect ocean waters during the construction and operation of seawater desalination facilities.
- Bacteria Amendment (2019): Revised statewide bacteria water quality objectives and implementation options to protect recreational users from the effects of pathogens (bacteria).

One key element of the Ocean Plan is stated under California Water Code Section 13142.5(b), which requires an Ocean Plan Determination for a range of seawater uses, including municipal intake (and discharge during testing) systems, and reads in part, as follows:

> *For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life.*

The Coastal Act supports the jurisdiction of the SWRCB relative to maintaining water quality for biological productivity and the protection of human and habitat health. The Act states that any development will be consistent with SWRCB Plans, including public service intake and outfall systems, per Article 2, Section 30705 and Article 4, Section 30233 (4): Incidental public service purposes, including, but not limited to, burying cables and pipes or inspection of piers and maintenance of existing intake and outfall lines. The most recent 2019 SWRCB staff review and proposed changes to the Ocean Plan proposed are presented at https://www.waterboards.ca.gov/water_issues/programs/ocean/docs/opr2019_dsfrpt.pdf

While land use practices that have the potential to impact water quality, the actions that change the shoreline (including public access), and the protection of coastal resources are handled by BCDC or CCC, depending on geographic region of the SF Peninsula. The actions and decisions on water supply, water rights, waste discharge requirements, and other specific water quality control actions are handled by the RWQCB. Overall, the level of difficulty for coordination and review time prior to approval from either the SWRCB or its RWQCB is considered high to moderate.

4.5.2.4 California State Lands Commission

The State Lands Commission ("Commission") has jurisdiction and management control over those public trust lands of the State received by the State upon its admission to the United States in 1850 ("sovereign lands"). For construction and operation of structures in waters of the state of California, a State Lands

Commission (SLC) lease application would be required in accordance with guidelines found at https://www.slc.ca.gov/wp-content/uploads/2018/07/Lease_App_Guidelines_2011.pdf. Generally, these sovereign lands include all ungranted tidelands and submerged lands, beds of navigable rivers, streams, lakes, bays, estuaries, inlets, and straits (Figure 4-2).

Exceptions for specific waterfront lots along the bayside of San Francisco exist pursuant to the San Francisco Beach and Water Lots Act (Chapter 41, Chapter 44, and Chapter 75, Statutes of 1851). The Act granted certain tidal and submerged lands in the city of San Francisco for private use and occupation for a term of ninety-nine years. Sales were carried out pursuant to the waterfront development plan known as the “Beach and Water Lots” and much of what is now downtown San Francisco passed into private ownership in this fashion. In 1863, the state Board of Harbor Commissioners took possession of all the waterfront of San Francisco, extending to six hundred feet into the waters of the bay (Legislature Chapter 306, Statutes of 1863).

In 1968, City and County of San Francisco, through the San Francisco Port Commission, was granted the land that had previously been under the jurisdiction of the San Francisco Port Authority, including all of the sovereign tide and submerged lands (slc.ca.gov).The Commission and the Port Commission (discussed further under Section 3.6.4 Local Jurisdictions) manages sovereign lands for the benefit of all the people of the State, subject to the Public Trust for water-related commerce, navigation, fisheries, recreation, open space and other recognized Public Trust uses. In addition, the State manages lands received after Statehood including Swamp and Overflowed lands and School lands. The Commission's Land Management Division in Sacramento administers the leasing of these lands, sand and gravel extraction from these lands, and dredging or disposal of dredged material on these lands. The Commission also manages the development of all mineral resources contained on such lands.

Upon receipt of an application or an inquiry about use of State lands, the Commission's Title Unit reviews its files and information submitted by the applicant to determine the extent of the State's property interest in the proposed project site. In some cases, the complex nature of the title to the lands may result in the applicant having to submit a title report (preliminary report of title or title policy) as part of the application process.

The lands managed by the Commission vary widely in character and utility. The Commission maintains multiple-use management practices to assure that the greatest possible public benefit is derived from these lands. The Commission will consider numerous factors in determining whether or not a proposed use of the State's land is appropriate including, but not limited to, the potential impacts on and the consistency with the Public Trust under which the Commission holds the State's sovereign lands, protection of natural resources and other environmental values, and preservation or enhancement of the public's access to State lands.

Other factors that the Commission will also consider are the size, location, intended use, and described need for the project/structure/facility, its relationship to the surrounding environment and if the size of the project/structure/facility is appropriate for the location and type of use or operation proposed. The Commission may approve, condition, or deny any application, based upon the above referenced factors or other issues raised during the application review process.

As with other affected jurisdictions within the state of California, the issuance of any lease, permit or other entitlement for use of State lands by the Commission requires review for compliance with the California Environmental Quality Act and no proposed project will be approved by a Responsible Agency under CEQA until its requirements been met.

The Commission has launched a new online system that allows the public to access, submit, and track lease and permit applications. It’s called the “Online System for Customer Applications and Records

(OSCAR)," and it went live in July 2019. It provides the Commission with new automation capabilities that enable it to accept and process applications and jurisdictional inquiries electronically.

While nominally a public lands leasing organization, their lease permit process requires substantial adherence to Ocean Plan, Bay Plan, and other stringent standards prior to granting leases for submerged state lands. The level of difficulty for coordination to obtain a California State Lands Commission (CSLC) lease within state submerged lands (ocean, bay, streams) is considered moderate.

4.5.2.5 California Department of Fish & Wildlife

California Department of Fish and Wildlife (CDFW) Region 3 includes the San Francisco Bay and Delta. CDFW takes on many authorities for other state and federal agencies under the California Fish and Game Code. For example, CDFW implements Incidental Take Permits for protected species under the federal ESA as well as additional species protected under the California ESA. CDFW has jurisdiction to implement and enforce fisheries regulations and to monitor EFH, pursuant to the federal MSA, as well as enforcing the federal Migratory Bird Treaty Act, which prohibits the take of any migratory bird. Under the Marine Life Protection Act, CDFW has the authority to control activities, recreation, education, and protections in state marine protected areas (marine reserves, marine conservation areas, and marine parks). There are several state marine protected areas in San Francisco Bay, but none that occur along the CCSF shoreline or nearby waters.

In addition to required consultation for endangered species as part of the USACE-issued 404 Permit and as part of the BCDC Permit, CDFW issues 1602 Lake and Streambed Alternation Permits pursuant to Fish and Game Code section 1602. A 1602 permit is required prior to beginning any activity that may use material from, divert, change, or obstruct the natural flow of any river, stream, or lake. CDFW also has a memorandum of understanding with the Water Board (1966). Under the terms of this MOU, the CDFW, formerly the Department of Fish and Game (DFG), agrees to notify the Water Board of any suspected violations of the Water Board's requirements for ocean disposal.

CDFW also has jurisdiction for land use and special access in the city's only state park, Candlestick Point State Recreation Area (see Appendix A). Developed in 1977, the park is in the East Bayfront subregion of the EFWS project study nearby Bayview/Hunters Point neighborhoods on landfill originally planned to be a naval shipyard after World War II. It is the state's first urban state recreation area. Public access includes trails, picnicking areas, bird watching, and an entry point for windsurfing on the bay. Pursuant to Fish and Game Code Sections 4305 and 4306, all wildlife and plant life is protected within the state park regardless of ESA listed status. All geological and anthropological features within the park boundaries also receive special status protection pursuant to Fish and Game Code Sections 4307 and 4308.Coordination with the CDFW to obtain Incidental Take Permits can be slow, even when providing full details and solid biological analysis. Largely due to limited review staff, completion of this process can take a year or more even under the best of conditions. Consequently, the level of difficulty for coordination and review time prior to approvals from the CDFW is considered moderate to low.

4.5.2.6 California Department of Transportation

An encroachment permit would be required when crossing into a California Department of Transportation (Caltrans) right-of-way. Their right-of-way within the city of San Francisco is depicted in Appendix A. An "encroachment" is defined in Section 660 of the California Streets and Highways Code. An encroachment permit is a contract between the Department and an encroachment permit holder, (permittee), that describes the terms and conditions under which you are granted permissive authority to enter onto State right-of-way to perform the activity. An encroachment permit grants permission to the permittee or their agent (a contractor) to perform the activity within the State's right-of-way, and assignment to another party is prohibited. An encroachment permit is not a property right, such as an easement, nor does it confer a property right. It cannot be transferred with the sale of real personal property.

Section 671.5 (a) of the California Streets and Highways Code requires that the Department either approves or denies an Encroachment Permit Application submittal within 60 calendar days, upon determination that the submittal is complete. The section grants the Department the authority in what constitutes a completed Encroachment Permit Application submittal. It also stipulates that an Encroachment Permit Application submittal is complete when all other statutory requirements, including CEQA, have been complied with. The actual time needed to review and approve your application will depend on the completeness of your submittal, scope, and complexity of the proposed work. A flowchart depicting the Caltrans encroachment permit process is provided in Appendix B.

Chapter 600, Utility Permits, from the Caltrans Encroachment Permits Manual states that it is Caltrans' policy is to allow utilities within conventional highway right-of-way subject to reasonable conditions and to exclude them from within access-controlled right-of-way to the extent practicable with few exceptions. Requests for utility encroachments that are not allowed by Caltrans policy or utility access within access-controlled right-of-way require an approved encroachment policy exception. The primary purpose of these policies is to protect both the public and highway workers from the hazards of a damaged, exposed, cut, or penetrated utility. The secondary purpose is to protect the public's investment in the highway system. Procedures for determining and collecting permit fees for utility facility encroachments owned by utility companies differ from those encroachments owned by private companies or developers. Usually, utility companies providing utility facility service to the public are billed for application and inspection fees whereas other companies pay fees at the time of application.

Chapter 602.5B details Longitudinal Utility Encroachments allowed for utilities running within and parallel to a Caltrans conventional highway right-of-way when required for publicly owned utility facilities dedicated to public use when approved by the Caltrans District (District 4). Requests for longitudinal encroachments by privately owned companies for their own use are not allowed.

The "Standard Encroachment Permit Application" (form TR-0100), instructions, plan set requirements, "EP Application Checklist" (form TR-0402) and other related forms can be found at http://www.dot.ca.gov/trafficops/ep/apps.html. Additional supporting documentation may be required depending on the scope of work such as: construction plans, location map, traffic control plans, letter of authorization, environmental documentation, storm water permit(s), certification of compliance with Americans with Disabilities Act, surety bonds, liability insurance, *etc.* Caltrans provides a flowchart guidance document, provided in Appendix B.

The Department's "Plans Preparation Manual" establishes uniform standards and procedures to be used when preparing right-of-way maps, preliminary exhibits, and the development of project plans. It is available at http://www.dot.ca.gov/design/cadd/manuals/ppm.html. All plans must comply with provisions of the California Business and Professions Code.

Given the number and type of likely encroachments, including the potential to seek longitudinal encroachments within a right-of-way, the review of engineering documents and completion of their approval process at Caltrans District 4 (Oakland) can take a year or more to complete. The relative level of difficulty for coordination and review time prior to approval from transportation agencies is considered low.

4.5.2.7 California Office of Historic Preservation

The California Office of Historic Preservation (OHP) administers federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable resources. The State Historic Preservation Officer (SHPO) is responsible for the operation and management of the OHP, as well as long range preservation planning. The Governor appoints the SHPO, in consultation with the State Historical Resources Commission and the Director of the Department of Parks and Recreation. OHP's responsibilities include:

- Identifying, evaluating, and registering historic properties
- Ensuring compliance with federal and state regulatory obligations
- Encouraging the adoption of economic incentives programs designed to benefit property owners
- Encouraging economic revitalization by promoting a historic preservation ethic through preservation education and public awareness and, most significantly, by demonstrating leadership and stewardship for historic preservation in California

Architectural Review and Incentives

OHP administers the Federal Historic Preservation Tax Incentives Program and provides architectural review and technical assistance to other government agencies and the public in the following areas:

- Interpretation and application of the Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties
- General assistance with and interpretation of the California Historical Building Code and provisions for qualified historic properties under the Americans with Disabilities Act
- Developing and implementing design guidelines
- Preservation incentives available for historic properties
- Sustainability and adaptive reuse of historic properties

OHP works with California's city and county governments to aid them in integrating historic preservation into the broader context of overall community planning and development activities by adopting a comprehensive approach to preservation planning which combines identification, evaluation, and registration of historical resources with strong local planning powers, economic incentives, and informed public participation.

Section 106 National Historic Preservation Act

For projects implemented or funded by a federal agency, coordination with the SHPO under Section 106 of the National Historic Preservation Act of 1966 (NHPA) would be required in addition to completion of the NEPA process for both archaeology and historic properties. Under Section 106 of the NHPA, actions with a federal nexus are required to consider the effects on historic properties, defined to include buildings, other structures, sites, objects, or districts. These include listings or eligible listings (determined in consultation with the SHPO) on the National Register of Historic Places, or in the city’s historic districts and conservation districts. San Francisco has 11 designated historic districts and six conservation districts and has recognized approximately 30 districts included in the California Register of Historical Resources, the National Register of Historic Places, or named as National Historic Landmark districts (see Appendix A). The NHPA also protects cultural items and archeologic sites significant to local Native American groups.

As part of a more detailed site alternatives analysis, review of the OHP’s California Historical Resources Information System (CHRIS) would be beneficial. It includes a statewide Historical Resources Inventory

(HRI) database maintained by OHP and the records maintained and managed by an independent regional Information center at Sonoma State University.

With proper analysis by qualified professionals, an, in certain cases the implementation of resource avoidance, coordination with the SHPO is a lengthy but manageable process. The relative level of difficulty for coordination and review time prior to authorization from the SHPO is considered moderate. A flowchart of the review process, along with the city's Planning Department's historic resource determination guide is provided in Appendix B.

4.5.3 Regional Jurisdictions

4.5.3.1 Region 2 - Regional Water Quality Control Board

Created by in 1967, the SWRCB implements Section 401, Certification Rule, under the federal Clean Water Act (CWA). Modified under the Porter-Cologne Water Quality Control Act (1970), the SWRCB coordinates with and supports Regional Water Boards to set statewide policy, and reviews petitions that contest Regional Board actions (waterboards.ca.gov). Regional boundaries are based on unique differences in climate, topography, geology, and hydrology for regional watersheds. Regional 2 RWQCB sets regional standards for San Francisco Bay under the Water Quality Control Plan (Basin Plan) for the San Francisco Bay region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation (waterboards.ca.gov).

The RWQCB's work cooperatively with the CCC and BCDC to establish and implement water quality objectives. See Section 3.6.2 for a summary of SWRCB cooperative ocean standards with the CCC.

BCDC and Region 2 RWQCB

Under the RWQCB Basin Plan, agreements potentially applicable to the EFWS initiative and affecting waters of San Francisco Bay include:

- Resolution No. 87-154: A memorandum of understanding between the SWRCB, Regional Water Board and BCDC that requires a project applicant to obtain all discretionary approvals from the Water Board before filing its BCDC permit application.
- MOU: No. 87-154: Applicants must acquire other state/regional approvals before applying for a BCDC permit
- Resolution No. 737: RWQCB cooperates with BCDC to ensure protection of bay waters and shoreline under the Bay Plan. Resolution 737 with BCDC requires wastes resulting from project permitted by BCDC to be connected to existing sewer lines, and to disapprove or temporarily withhold approval of any project that would cause added waste loading on a community sewerage system that is not meeting Board waste discharge requirements. In addition, the regulation of discharges for temperature to coastal waters, bays and estuaries is outlined in the Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California, known as the State's Thermal Plan (see Section 3.6.2).
- Resolution No. 70-19: Wastes resulting from BCDC-permitted projects are to be connected to existing sewer lines; and temporary or permanent disapproval of a project that would cause added waste loading on a community sewerage system that does not meet Board waste discharge requirements.

USACE and Region 2 RWQCB

Region 2 RWQCB issues Section 401 of the Clean Water Act water quality certifications and National Pollutant Discharge Elimination System (NPDES) permits. An NPDES permit addresses water pollution by regulating point sources that discharge pollutants to jurisdictional Waters of the US (epa.gov). Section 401 requires that any applicant for a USACE-issued Section 404 CWA permit also obtain a Water Quality Certification from the State. Section 401 permits cover any discharge and/or fill materials, as well as water quality standard compliance (in.gov). Under the federal 1972 CWA NPDES permit program, the EPA authorizes state, tribal, and territorial governments such as the RWQCB, enabling them to perform many of the permitting, administrative, and enforcement aspects of the NPDES program (EPA retains oversight responsibilities).

Related Local Water Quality Programs

- Existing NPDES permits issued to the CCSF for the operations of the Southeast and Oceanside Water Pollution Control Plants, the City is required to implement a Pretreatment Program. This Program is required to comply with the regulations incorporated in the Clean Water Act (33 USC Section 1251) and the General Pretreatment Regulations (Title 40 CFR Part 403) (sfwater.gov).
- The California State Construction General Permit requires the development of a Storm Water Pollution Prevention Plan (SWPPP) and/or Erosion Sediment Control Plan (ESCP), depending on site conditions. These permit applications are submitted to SFPUC and to Public Works through the City's Construction Site Runoff Control Program.
- Under CEQA and CWA provisions, the SWRCB also adopted a General Waste Discharge Requirement (WDR) in 2006 for all publicly owned sanitary sewer systems in California with more than 1 mile of sewer pipe. The goal of the WDR is to provide a consistent statewide approach for reducing system overflows. The WDR requires that SFPUC prevent untreated wastewater from entering storm drains, creeks, or other watersheds by developing a Sewer System Management Plan (SSMP). If an overflow occurs, the SSMP contains mandatory report requirements. Additional regulations governing these discharges are contained in the City's sewer use ordinance - Article 4.1, Chapter X, Part II of the San Francisco Municipal Code. Additional wastewater pollutant limitations are contained in the City's Public Works Order No. 158170 (see sfwater.gov).
- Stormwater is conveyed separately and discharged directly into the bay, the ocean, or Lake Merced without receiving treatment, a system collectively referred to as the Municipal Separate Storm Sewer System (MS4). Construction projects in MS4 areas must comply with Statewide General Permit requirements (SWRCB Order 2009-0009-DWQ) in addition to the City's Construction Site Runoff Control Ordinance (see Public Works Code 260-13).

The level of engineering and other technical analysis required to determine potential water quality effects during construction and to adhere to the guidance for intake and discharge in the Ocean Plan, among other land-based effects, require early examination and collaboration with Water Board staff to provide results using accepted methods and parameters. A RWQCB authorization under the Ocean Plan is required prior to approval of a Coastal Development Permit from the CCC. The level of difficulty for coordination and review time for approvals from the RWQCB is considered moderate.

4.5.3.2 Bay Area Air Quality Management District

The Bay Area Air Quality Management District's (BAAQMD) Regulation 2 Rule 1 describes the permit requirements for sources of air pollution. In general, any equipment or operation that emits pollutants into the atmosphere requires a Permit to Operate from the District unless it is excluded from District

Regulations per Regulation 1 or exempted from District permit requirements by a specific section of Regulation 2 Rule 1. Any air pollution control equipment, associated with a source that requires a District permit, is also required to have a Permit to Operate from the District. Facilities may use the Permit Exemption Guidance to aid in determining whether a source is required to have a permit or is exempt from permit requirements.

A flow diagram of the BAAQWMD's permitting process is provided for illustrative purposes in Appendix B. If an application is not complete, the APCO shall notify the applicant in writing and indicate what additional data or fees are required to complete the application. Typically, the District must review and determine whether an application is complete within 15 working days of receipt of the application

Stationary diesel engines are internal combustion engines used in generators, pumps, and material handling equipment (such as tub grinders). The primary pollutants from internal combustion engines are oxides of nitrogen (NOx), hydrocarbon and other organic compounds (POCs), carbon monoxide (CO), sulfur dioxide (SO2), and particulate (PM10). In calculating these emissions, emission factor data from CARB, EPA, and/or the manufacturer are used to estimate emissions for NOx, CO, POC, and PM10.

For emergency standby diesel engines, the owner or operator shall operate only to mitigate emergency conditions, for emission testing to demonstrate compliance with a district, state, or federal emission limit, or for reliability-related activities (maintenance and other testing) but excluding emission testing. Operating while mitigating emergency conditions or while emission testing to show compliance with district, state or federal emission limits is not limited.

A permit application cannot be approved unless a modeling analysis demonstrates that the proposed source emissions will not interfere with the attainment or maintenance of a National Ambient Air Quality Standard (NAAQS), and, if applicable, will not cause an exceedance of a prevention of significant increment. For District purposes, NAAQS is defined to include both California and national standards. Guidance from the District's Engineering Division is available for the applicant's use to give the permit applicant specific assumptions, requirements, conventions, and procedures for the preparation of a modeling analysis. Because this guidance cannot cover every aspect of the analysis needed for a proposed source without becoming unwieldy, the applicant should submit a modeling plan (protocol) with their application before beginning the analysis, per the Permit Handbook found at https://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf.

Once it has been determined that a permit is required for a particular source or operation, a facility obtains the required permit by submitting a permit application package to the District's Engineering Division. The Engineering Division of the District issues and renews air quality permits for equipment that emits or controls the emission of air pollution from large and small facilities. If a facility is unsure about whether a permit is required, it is advisable to submit a permit application package for the operation; and the District will make the final determination.

A flow diagram of the BAAQWMD's permitting process is provided for illustrative purposes in Appendix B. Typically, the District must review and determine whether an application is complete within 15 working days of receipt of the application. With the use of standard equipment emissions specifications for internal combustion engines, the relative level of difficulty in obtaining a BAAQMD permit to construct or permit to operation is considered low.

4.5.3.3 Bay Area Rapid Transit and Caltrain

Bay Area Rapid Transit

If work is to be done on Bay Area Rapid Transit (BART) property, or if it is determined that inspection or monitoring will be needed for your project, a permit will be required. Their right-of-way within the city of San Francisco is depicted in Appendix A. The BART Real Estate and Property Development Department coordinates permits and plan review for any construction on, or adjacent to, a BART right-of-way. For subsurface crossings, refer to the General Guidelines for Design and Construction Over or Adjacent to BART's Subway Structures.

An application for construction permit must be completed along with the appropriate fee, including an as-built deposit and four sets of plans showing the proposed construction. After receipt of a completed and executed application, a work order is opened to support Department time charged to the project. The following types of BART standard permits should be anticipated for a proposed water pipeline crossing: Utility Permit (general utility work within existing easements by utility companies or self-insured entities), Permit to Enter (construction of temporary improvements on District property), and/or Permit to Enter (.pdf) (construction of permanent improvements on District property).

BART staff uses the application information to prepare the appropriate permit. BART staff will assign a permit number and add conditions specific to your permit based on plan review, including insurance certificates and endorsements. All permit issued by BART are subject to the General Terms and Conditions Relating to Utility Permits. A request to purchase an easement is treated just like a permit and is also subject to the Fee Schedule.

Caltrain

Caltrain's Peninsula Corridor Right-of-Way is a property owned by the Peninsula Corridor Joint Powers Board, which sets policies regarding requests for property conveyance and related access agreements. Their right-of-way within the city of San Francisco is depicted in Appendix A. Typical types of access agreements issued by Caltrain and a description of their standard form of agreement for each type of agreement to enter their right-of-way include:

- **Encroachment Permit***:* Used to allow third parties access to Caltrain-owned property for a specific purpose when a lease is not appropriate. An encroachment permit would be appropriate to allow non-continuous occupancy. This short-form permit is not appropriate for construction activities, not even surveying or potholing.
- **Right-of-Entry Permit Agreement***:* Required to allow third-party access to Caltrain property for a specified period to accomplish a specified activity, which generally involves construction.
- **License Agreement***:* Issued to allow a permanent or semi-permanent facility to be constructed on Caltrain property. The license agreement allows the facility to be initially constructed and then remain in place. Depending on the situation, typically a Right-of-Entry Permit Agreement is required every subsequent time the licensee wished to access the facility for construction and/or maintenance.

Agreements are issued through the Caltrain Real Estate and Property Management Department and requires insurance coverage of $2 million per occurrence and $2 million aggregate General Liability insurance coverage. The permittee is typically charged a processing fee to cover Caltrain's cost in reviewing the request and issuing a permit, as well as an annual fee for use of the property. Overall, the relative level of difficulty to obtain a Caltrain encroachment permit is low; however, when a longitudinal right-of-way crossing (lengthwise within the right-of-way) is involved the level of difficulty can be greater.

4.5.4 Local Jurisdictions

4.5.4.1 City of San Francisco Local Coastal Plan (LCP)

The San Francisco Coastal Zone extends from the Point Lobos recreational area in the north to the Fort Funston cliff area in the south (refer to Figure 4-1). The Local Coastal Program (LCP) is a policy and regulatory document required by the 1976 California Coastal Act that establishes land use, development, natural resource protection, coastal access, and public access. San Francisco's Local Coastal Program was originally certified in 1986 and amended in 2018. The policies of the LCP were incorporated into the Western Shoreline Area Plan, the element of the General Plan that establishes land use, development, and environmental policies for the designated area. Projects that require a Coastal Zone Permit from the Planning Department shall be reviewed for consistency with the city's Western Shoreline Plan, within the San Francisco General Plan (sfgov.org).

Actions requiring a Coastal Zone Permit include, but are not limited to: new construction, demolition, or alterations of structures, divisions of land, activities that change the intensity of use of land or public access to coastal waters, rip-rap repair, dredging, repair or maintenance to structures located in an environmentally sensitive habitat area, and alterations of land forms including removal or placement of vegetation, on a beach, wetland or sand dune, or within 100 feet of the edge of a coastal bluff, or stream or in areas of natural vegetation (SF Planning Code Section 330). Provided the project adheres to the goals and objectives within the city's LCP, including public involvement, the level of difficulty is estimated to be low. Note that portions of the area under the LCP is appealable to the CCC, meaning any decision by the City can be appealed to the CCC by a person or entity willing to pay a large fee.

4.5.4.2 Port of San Francisco

The Port of San Francisco manages the waterfront as the gateway to a world-class city, and advances environmentally and financially sustainable maritime, recreational and economic opportunities to serve the City, Bay Area, and California (refer to Figure 4-2). The Port is governed by a five-member Board of Commissioners, each of whom is appointed by the Mayor and subject to confirmation by the City's Board of Supervisors. Each commissioner is appointed to a four-year term. The Port Commission is responsible for the seven and one-half miles of San Francisco Waterfront adjacent to San Francisco Bay, which the Port develops, markets, leases, administers, manages, and maintains. Its jurisdiction stretches along the waterfront from Hyde Street Pier on the north to India Basin on the south.

The Port of San Francisco Waterfront Plan (2015) sets forth land use and development policies adopted by the San Francisco Port Commission by subareas for all properties within the Port's jurisdiction. It focuses on maritime areas, open spaces and public access, and residential and commercial uses. Leases or encroachment permits are issued based on policies within a subarea. The Waterfront Plan is available at https://sfport.com/waterfront-land-use-plan-chapters.

The Waterfront Plan provides the foundation for Port efforts to integrate public and private investment to improve the waterfront for broad public use and enjoyment. It includes a comprehensive public access and open space plan along the waterfront, integrated with the Port's varied maritime industries, and opportunities for new public-private partnership projects. The Waterfront Plan includes a Waterfront Design & Access Element which provides direction on how projects should be designed to respect and enhance the waterfront's historic character, create architectural delights, and attract people to enjoy a wide range of activities.

Port Resilience Projects

The Port has been planning for sea level rise for years. In recognition of the Port's critical role in creating a resilient waterfront, the Port Commission requires that every project consider current and future flooding. Every new project means a stronger waterfront. This innovative approach is leading to sea level rise adaptation and project implementation along the waterfront, including the following projects:

- Downtown San Francisco Ferry Terminal Expansion Project
- Fire Station 35
- Mission Bay Ferry Landing
- Mission Rock
- Pier 70

The USACE and the Port have partnered to study flood risk along San Francisco's bayside shoreline. The USACE/Port Flood Study area begins just north of the Port's jurisdiction at Aquatic Park and ends just south of Heron's Head Park at the Port's southern boundary.

The Port leads the Embarcadero Seawall Program, a citywide effort to strengthen the 3-mile Embarcadero Seawall from earthquake, flooding, and sea level rise risks. The Program is currently in the planning stage, following an extensive vulnerability study. Critical life safety projects are estimated for completion by 2026. The Program will take decades to complete and is estimated to cost up to $5 billion.

To enable waterfront revitalization, the Port works closely with the San Francisco Planning Commission and its Board of Supervisors, the San Francisco BCDC, and the California State Lands Commission to align the various land use plans and policies held by each entity. Port projects must comply not only with the Waterfront Plan, as well as respond to the objectives of these regulatory agencies. This is important to minimize confusion between agencies and streamline the entitlement process for individual projects.

There are a host of Port codes for buildings and piers accessed at https://sfport.com/codes-guidelines-regulations. No single code or specific guidance is identified regarding utility crossings and waterfront access. Port properties on piers and within 100 feet of the shoreline are subject to BCDC permit requirements (https://sfport.com/sharedspaces). With proper technical review and siting of infrastructure conducted in concert with the Port staff, the level of difficulty for obtaining a Port lease or encroachment permit is moderate.

4.6 Areas of Known Contamination

In San Francisco, local government takes the lead for land use decisions related to hazardous waste facilities and for emergency response programs. State government oversees the management of hazardous waste including all transport activities. The federal government has taken the lead in regulating and in some cases funding the cleanup of past contamination which all levels of government now seek to prevent (SF General Plan).

The County of San Francisco is required to include a Hazardous Waste Management Plan as part of the General Plan under The Tanner Act of 1986. Hazardous waste mandates were developed by the Office of San Francisco's Chief Administrative Officer in conjunction with a citizens advisory group. The plan was approved by the Board of Supervisors in 1992 and by the State EPA in 1995. San Francisco Health Code Article 22A, "Maher Ordinance" requires San Francisco Department of Public Health oversight for the characterization and mitigation of hazardous substances in soil and groundwater in designated areas zoned for industrial uses, sites with industrial uses or underground storage tanks, sites with historic bay fill, sites in close proximity to freeways or underground storage tanks (see Appendix A). Actions within an area disturbing a minimum of 50 cubic yards require prior contact with the Department of Public Health as part of the Planning Department's building permit process.

As with all planning areas within the city, more fine-scale analysis should be obtained during the consideration of alternative sites. Depending on the locations selected for EFWS infrastructure, oversight by the City Department of Public Health, the level of difficulty in concurring with a preferred alternative is expected to be low.

4.7 Summary of Key Regulatory Considerations

Understanding and early coordination of environmental compliance and permit acquisition efforts will result in a more efficient project planning and public outreach efforts. Environmental compliance includes the preparation of NEPA and CEQA documentation so that affected NEPA lead federal agencies and the City of San Francisco, as a lead CEQA agency can document their decision-making process under the federal and state policies. Concurrent and subsequent efforts associated with permit acquisition and various encroachment and lease approvals from public agencies would also be required. Likely affected federal, state, and local/regional agencies involved with reviewing and authorizing portions of the project are summarized in Table 4-4.

Primary shoreline regulatory agencies (those typically having a final say in the overall approval process) vary depending on the location of off-shore and near-shore intake structures, pipelines, and, potentially, pump station infrastructure. In general, these agencies would include the CCC and NPS on the ocean side of the city west of the Golden Gate Bridge (though some NPS jurisdiction on the bay side occurs just east of the bridge, too). The Presidio Trust would also be a primary decision-maker where it has responsibilities in upland areas immediately west of the bridge, and the City of San Francisco would be a primary decision-maker for upland areas within its Local Coastal Program further south. On the bay side, BCDC is the primary shoreline decision making body. In general, BCDC is expected to have a less onerous and more streamlined review and approval process compared to the CCC. The potential challenge or degree of difficulty in obtaining permits from these primary shoreline regulatory agencies is generally moderate to high.

Secondary shoreline regulatory agencies (those that also issue permits, that are typically obtained prior to final authorizations from primary shoreline regulatory agencies), include the USACE, CDFW, RWQCB, CSLC, the City of San Francisco and the Port of San Francisco for in-water and nearshore upland infrastructure. The potential challenge or degree of difficulty in obtaining permits from these agencies is generally low to moderate, except for the RWQCB, which is high due to compliance with the Ocean Plan and Bay Plan water quality standards. On the bay side, substantial interaction with the Port of San Francisco may also be required where they have jurisdiction.

Other upland regulatory jurisdictions that extend from the near-shore area into the interior of the city include various city public works, planning, parks and transportation departments, state parks and historic resource agencies, state and regional transportation and air quality, agencies and various other local stakeholders.

It should be noted that the existing Pump Stations 1 and 2, fireboats, and suction connections for the EFWS do not meet these current requirements. Since the use of seawater intakes to supplement the EFWS will not be a regular, ongoing withdrawal of seawater from either the ocean or the bay, the regulatory agencies may be amenable to relaxation of their normal requirements.

Depending on the preferred course of action, NEPA and CEQA efforts may take 18 to 24 months, and subsequent permitting would take up to 24 months.

Table 4-4: Summary of Prospective EFWS Regulatory Permits and Authorizations

Regulatory Agency	Permit/Agreement Name	Applicable Project Component(s)	Potential Level of Difficulty/Comments
Federal			
USFWS	Section 7 ESA Biological Opinion	Work in terrestrial species habitat	Low in urban environment.
NMFS	NMFS Section 7 ESA Biological Opinion or no adverse effect letter	Work in marine species habitats	Moderate in marine environment.
USACE	Section 10 Rivers & Harbors Act	Work within waters of the U.S. /wetlands	Low given footprint in marine environment
	Section 404 CWA Permit		Low given limited wetlands potentially affected
NPS	Easements	Infrastructure within Park Lands	Moderate
Presidio Trust	Easements	Infrastructure within Trust Lands	Moderate
USCG	Authorization	Structures in navigable waters	Low
State/Regional			
SHPO	Section 106 Consultation	All	Moderate in urban environment
CDFW	CESA Section 2081 Incidental Take Permit	Infrastructure in key habitat	Low in urban environment
	Section 1602 Lake and Streambed Alteration Agreement	Infrastructure in lakes & streambeds	Moderate to Low given footprint in lakes and streams.
SWRCB	Sec 13142.5(b) Ocean Plan Determination	Work within Pacific Ocean	High given Ocean Plan guidance for seawater intake
Caltrans	Encroachment Permits	Pipeline in Route 1	Low
State Parks	Right of Entry	Pipeline crossing State Parks	Low
RWQCB	Section 401 CWA Water Quality Certification (WQC)	Work requiring USACE permit	Moderate given potential discharge volume
	NPDES Construction General Permit	All new construction	Low
CCC	Coastal Development Permit	Work within Coastal Zone	High given Coastal Act or Local Coastal Program policies
BCDC	Development Authorization	Work in bay submerged lands/shorelines	Moderate to High depending on the extent and location
CSLC	State Lands Lease	Work within State (Submerged) Lands	Moderate depending on resource impacts
Regional/Local Approvals			
SF City/County	Coastal Development Permit	Work within City	Low
Port of SF	Lease or Encroachment Permit	Pipeline in Port Jurisdiction	Moderate
BAAQMD	Permits to Construct and Operate	Pump Station(s)	Low
Caltrain/BART	Encroachment Permit	Pipelines	Low

Chapter 5: Seawater Supply Location Considerations

This chapter describes the various geographies that were identified and evaluated to provide a structured assessment of seawater supply opportunities and challenges as part of an expanded EFWS system. The ocean and bay shoreline regions surrounding the city of San Francisco have been divided into five subregions. These shoreline subregions include the Southern Dunes, Rocky Area South, Rocky Area North, North Bayfront, and East Bayfront, as shown in Figure 5-1. Each of these subregions and their general suitability for a new seawater supply facility are described below.

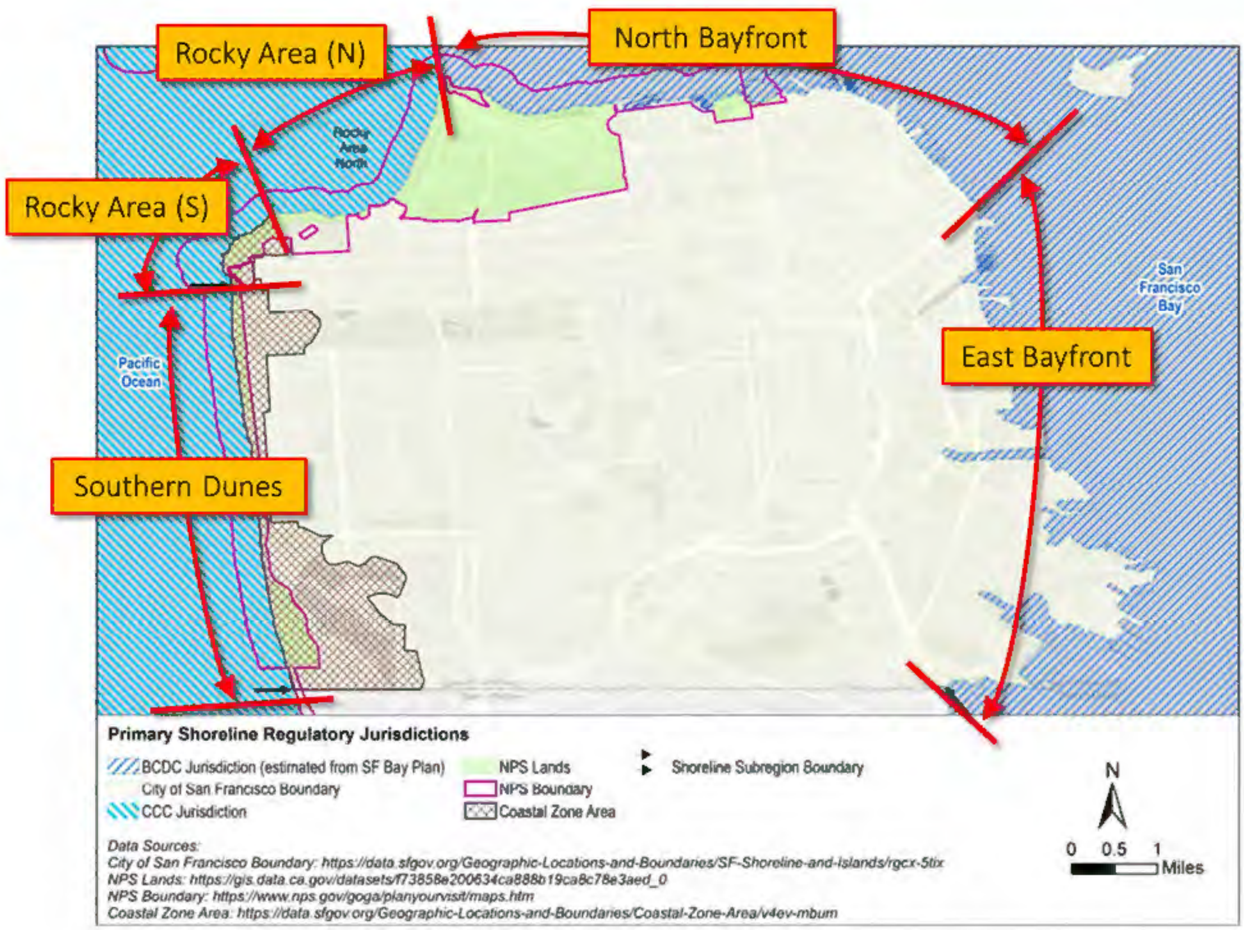


Figure 5-1: San Francisco Subregions Considered for Seawater Supplies to EFWS

5.1 Pacific Ocean Region

The Pacific Ocean region includes the Pacific coastline from the southern city limits near Fort Funston to the Golden Gate Bridge and is the region where the CCC has primary jurisdiction. It is divided into three subregions as described below.

5.1.1 Southern Dunes Subregion

The Southern Dunes subregion includes the area from the city limits near Fort Funston north approximately 4.7 miles to Balboa Street, two blocks north of Golden Gate Park. Figure 5-2 shows the portion of this subregion considered for a new seawater supply facility (circled in purple).

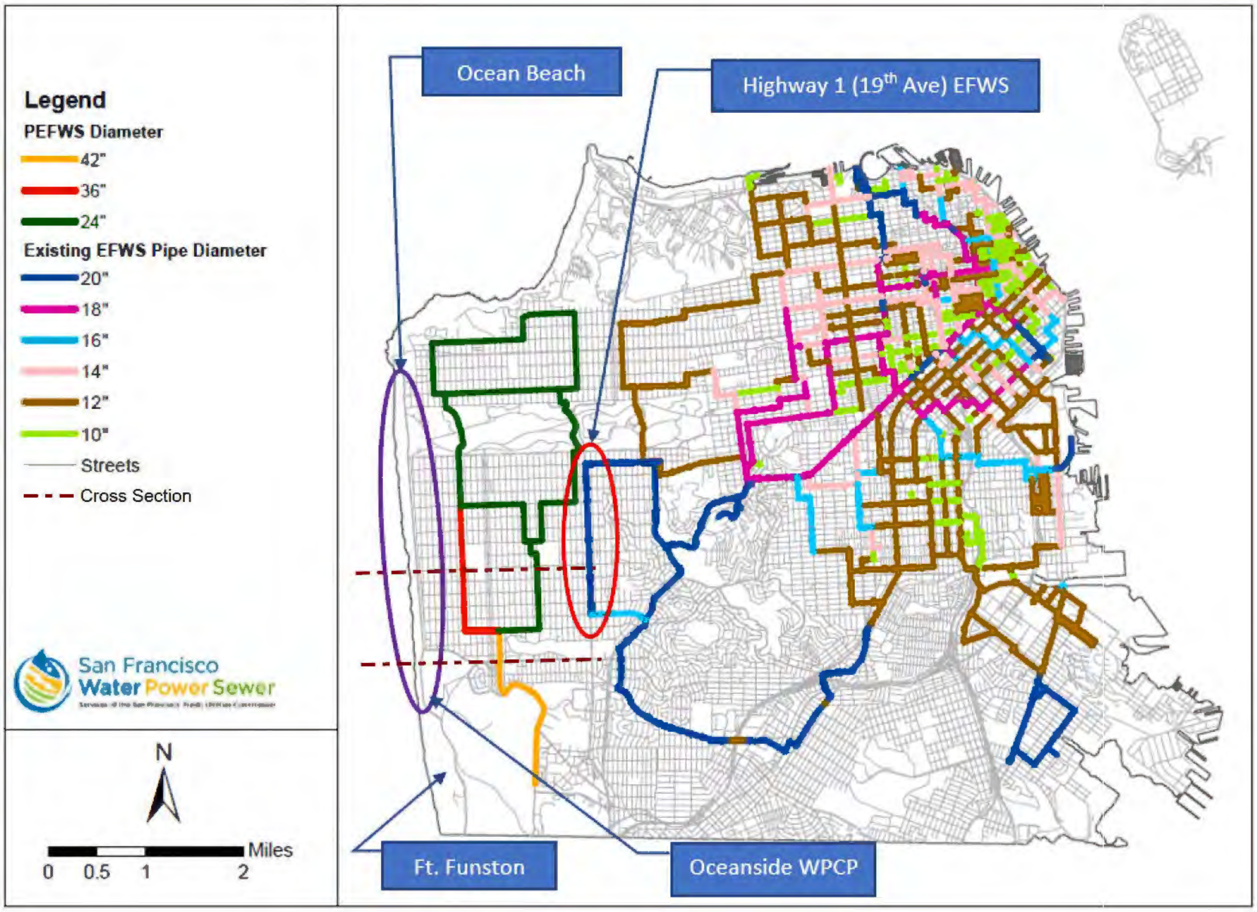


Figure 5-2: Potential Seawater Supply Locations – Southern Dunes Subregion

Near Fort Funston on the southern end, the topography is characterized by sandy cliffs rising sharply from the beach to a bluff upon which remnants of the former fort still sit. The cliffs range in height from approximately 75 to 200 feet above the beach level from north to south. North of Fort Funston, from roughly SFPUC's Oceanside Water Pollution Control Plant (WPCP) to Balboa Street is Ocean Beach, a relatively wide and flat sandy beach with occasional low-lying dunes between it and the Great Highway that runs along its eastern edge. Topographic cross-sections from the ocean inland at two typical locations along Ocean Beach are shown in Figure 5-3 and Figure 5-4. The locations of these cross-sections within the subregion are shown in Figure 5-2.

Figure 5-3: Typical Cross Section – Sloat Boulevard

Figure 5-4: Typical Cross Section – Quintara Street/Sunset Reservoir Area

The Ocean Beach section would be a suitable location for a new seawater supply facility. A preferred location for a seawater pump station should be considered as close as possible to the beach but east of the Great Highway, outside of the jurisdictional limits of the CCC, NPS, and the City's Coastal Zone. Regardless of the pump station location, however, its intake from the ocean would cross land regulated by these agencies, so they will still be involved in the permitting process. Either type of intake (open water or slant wells) is considered feasible within this subregion, although regulatory preferences and/or requirements may lean more towards one type than the other. Both intakes types are discussed in more detail in Chapter 7.

Location will ultimately determine the type of intake that is most feasible from an engineering perspective. On Ocean Beach, slant wells may be the preferred choice up to a certain discharge capacity, but beyond that capacity the sheer number of wells required to produce a desired flow rate may make them impractical and/or cost prohibitive when compared to a single intake tunnel with an onshore pump station.

For example, preliminary estimates of slant well production using publicly available hydrogeologic data for the Pacific coastline in San Francisco indicate that up to 17 slant wells could be required to produce a total flow rate of 50,000 gpm. Cost, access, land requirements, environmental impacts, and permitting may prove challenging for a large number of wells. Flow withdrawals of this magnitude could also have an impact on local groundwater levels on the west side of the city, which could create performance issues for existing municipal water supply wells.

Additional analysis and groundwater modeling using more site-specific data are necessary to develop a more accurate estimate of well production. This analysis generally would be performed during the planning phase and could change the number of wells required at a given site. Regulatory influences may also play a large part in the type of intake selected.

Hydrogeologic characterization of the Pacific Ocean coastline is addressed in Section 7.2.4.

For a seawater supply facility located near Ocean Beach between Sloat Boulevard on the south and Lincoln Way on the north, it is approximately 1.7 miles to the nearest existing EFWS piping in 19th Avenue. Figure 5-2 shows the existing EFWS and planned PEFWS networks within the city and their proximity to this subregion. The EFWS piping is only 20-inch diameter in this area, so it may need to be upsized to accommodate the additional inflow for some distance beyond the connection point. This would need to be evaluated using iterative hydraulic modeling.

5.1.2 Rocky Area South Subregion

The Rocky Area South subregion includes the area from Balboa Street at the north end of Ocean Beach to Point Lobos. Figure 5-5 shows the portion of this subregion considered for a new seawater supply facility (circled in purple).

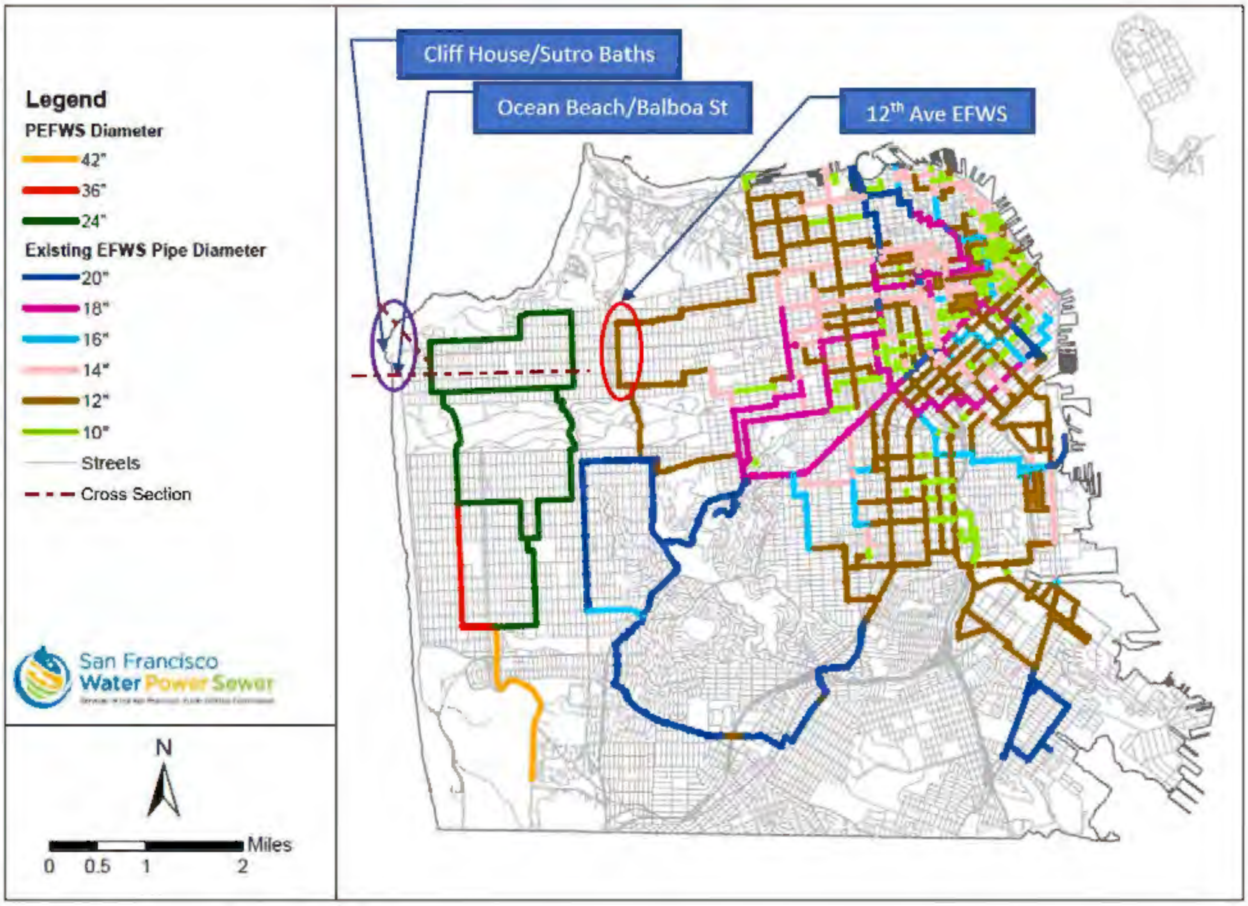


Figure 5-5: Potential Seawater Supply Locations – Rocky Area South Subregion

The topography is primarily characterized by steep, rocky cliffs rising sharply from a narrow, rocky beach to a bluff ranging from approximately 100 to 240 feet above the beach level depending on location. The very southern end of this subregion at Balboa Street may be a potential location for a new seawater supply facility as it still has relatively easy access to Ocean Beach. Siting a pump station anywhere north of this area would be a greater challenge; due to the narrow width of the beach, a pump station would need to be placed on the bluff above the cliffs. Construction access to the beach would also be difficult.

The subsurface geology of the cliffs and bluffs is predominately bedrock, which would limit opportunities for subsurface intakes such as slant wells. An open-water intake tunnel may be possible; the intake tunnel would need to be bored underneath the beach and cliffs and a submerged intake pipe extended horizontally out (or vertically up) into the ocean above the seafloor with screens on the end. A vertical access shaft would also need to be installed at the pump station building on the surface of the bluff. A pump station in this area would sit on federal land managed by the NPS as part of the GGNRA.

Topographic cross-sections from the ocean inland have been developed for two hypothetical locations within this subregion. These are shown in Figure 5-6 and Figure 5-7. The locations of these cross-sections within the subregion are shown in Figure 5-5.

Figure 5-6: Typical Cross Section – Balboa Street

Figure 5-7: Typical Cross Section – Lands End Area

From Balboa Street near Ocean Beach, the distance to the existing EFWS piping in 12th Avenue is approximately 2.2 miles along existing roads. Figure 5-5 shows the existing EFWS and planned PEFWS networks within the city and their proximity to this subregion.

As with the Southern Dunes area, a preferred location for a seawater pump station should be considered as close as possible to the beach but east of the Great Highway, outside of the jurisdictional limits of the CCC, NPS, and the City's Coastal Zone. The existing EFWS piping is only 12-inches in diameter in this vicinity, so it may need to be upsized to accommodate the additional inflow. Assessment of required pipe sizes would need to be evaluated using iterative hydraulic modeling.

Both subsurface and open water intakes are considered feasible at this location. It may not be feasible or desirable to use slant wells if the desired total discharge capacity is over 30,000 gpm. Based on preliminary hydrogeologic desktop analysis of the area, it is estimated that up to 10 slant wells may be required to produce a total flow rate of this magnitude at Ocean Beach; even more wells would be required for larger capacities.

5.1.3 Rocky Area North Subregion

The Rocky Area North subregion includes the area from Point Lobos to the Golden Gate Bridge. Figure 5-8 shows the portion of this subregion considered for a new seawater supply facility (circled in purple).

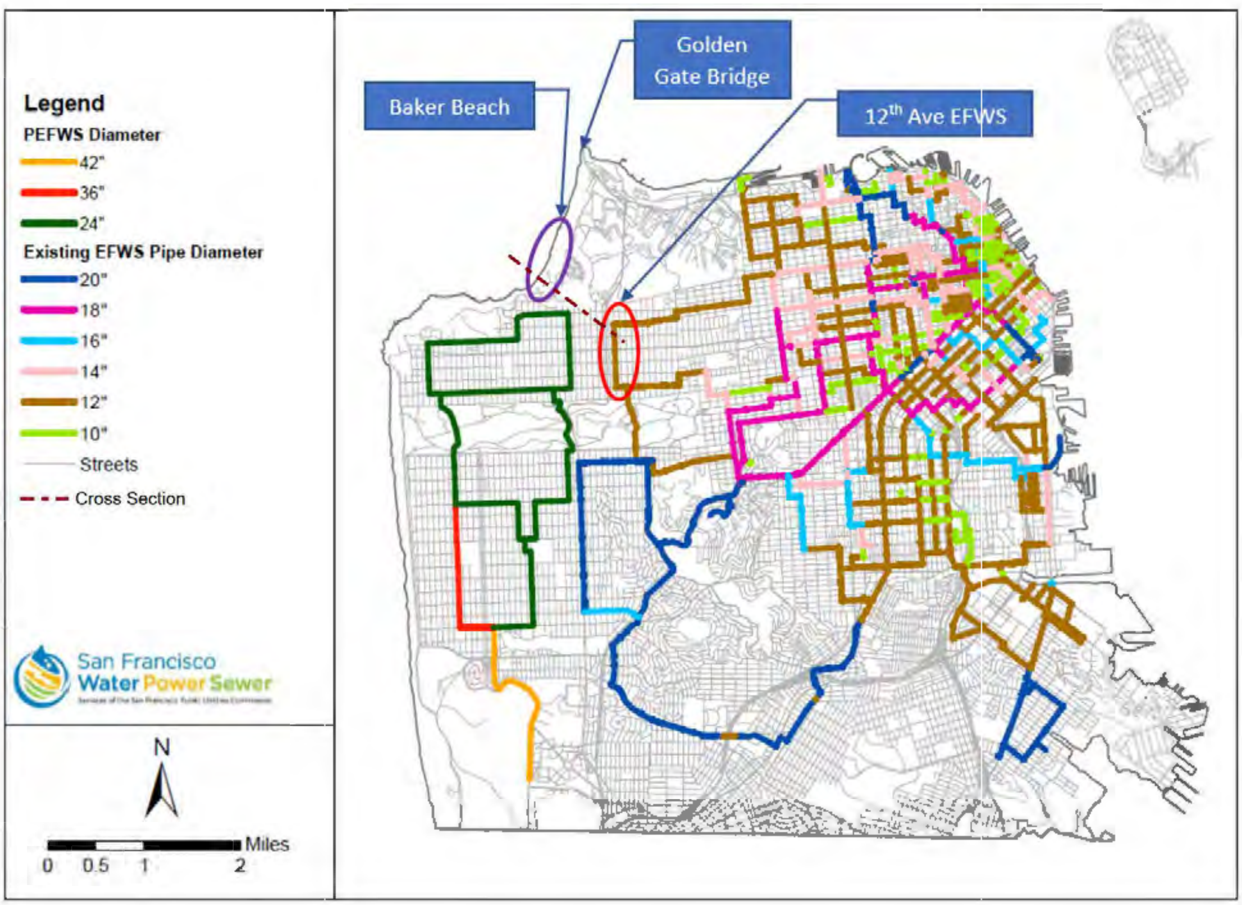


Figure 5-8: Potential Seawater Supply Locations – Rocky Area North Subregion

Like the Rocky Area South subregion, much of the topography is characterized by steep, rocky cliffs rising sharply from a narrow, rocky beach to a bluff ranging from approximately 100 to 250 feet above the beach level depending on location. However, approximately one-quarter of this subregion also includes Baker Beach, a wide, gently sloping sandy beach at the foot of milder hillside slopes that rise approximately 100 to 150 feet from the beach to the bluff above. A topographic cross-section from the ocean inland at Baker Beach is shown in Figure 5-9.

Figure 5-9: Typical Cross Section – Baker Beach Area

Baker Beach may be a feasible location for a new seawater supply facility. From this area, the nearest connection point to the existing EFWS network in 12th Avenue is approximately 1.5 miles along existing roads. Figure 5-8 shows the existing EFWS and planned PEFWS networks within the city and their proximity to this subregion. The EFWS piping is only 12-inches in diameter at this location, so it may need to be upsized to accommodate the additional inflow from the facility.

Both slant wells and an open-water intake tunnel are considered feasible at Baker Beach. Outside of the Baker Beach area the subsurface geology is like that in the Rocky Area South subregion, predominately bedrock. As such, only an open-water intake tunnel would be considered feasible, installed in the same manner and under the same conditions as one in the Rocky Area North subregion. A seawater pump station built at Baker Beach or in the bluff area of this subregion would also sit on federal land managed by the NPS or Presidio Trust as part of the GGNRA.

5.2 San Francisco Bay Region

The San Francisco Bay region includes the San Francisco Bay shoreline from the Golden Gate Bridge to the southern city limits near Candlestick Point as shown in Figure 5-1, and is the region where BCDC has primary regulatory jurisdiction. It is divided into two subregions as described below.

5.2.1 North Bayfront Subregion

The North Bayfront subregion includes the area from the Golden Gate Bridge to the Bay Bridge. Figure 5-10 shows the portion of this subregion considered for a new seawater supply facility (circled in purple).

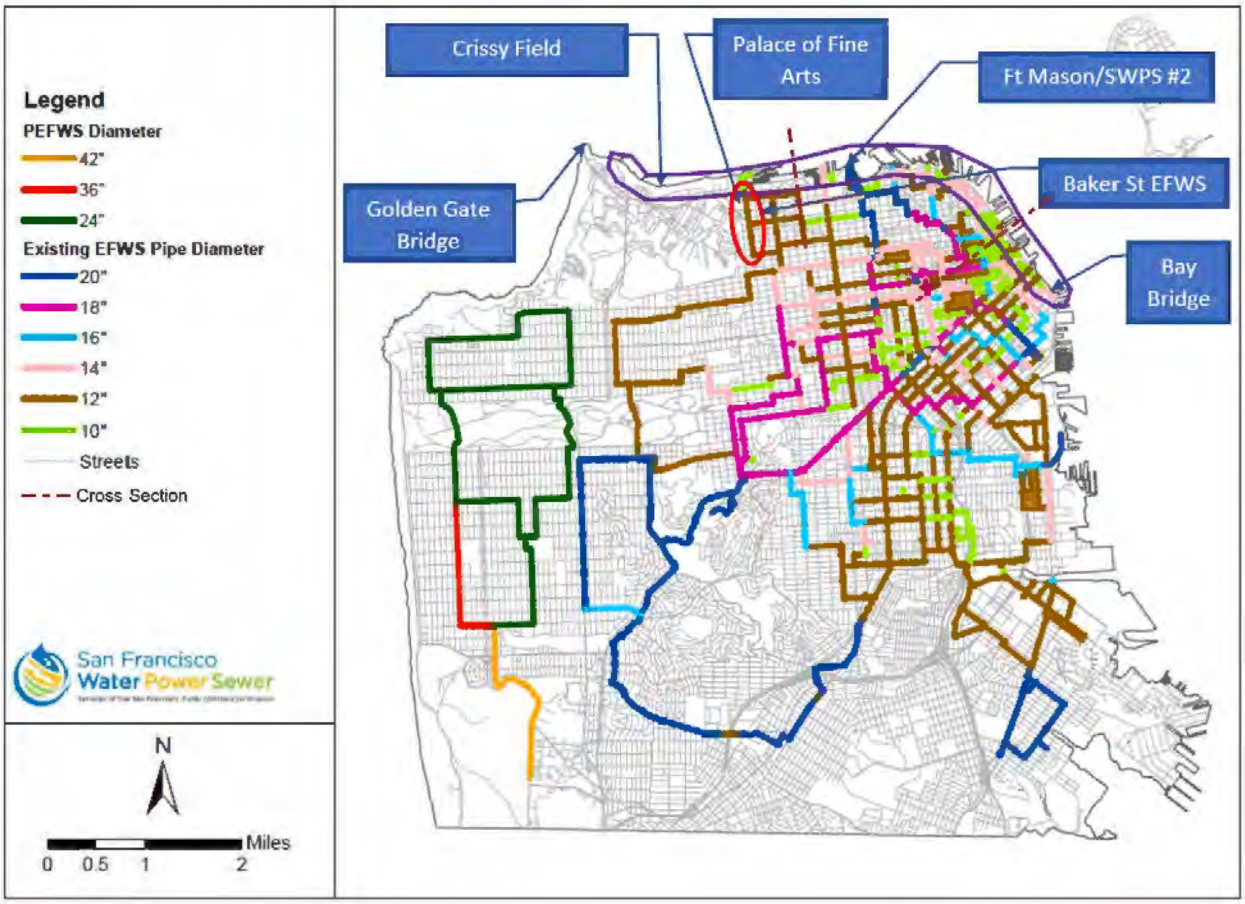


Figure 5-10: Potential Seawater Supply Locations – North Bayfront Subregion

The topography is characterized by having moderately steep, rocky cliffs rising from a narrow, rocky beach from the Golden Gate Bridge east to Crissy Field; relatively wide, flat beaches and open ground along Crissy Field to the San Francisco Marina; open ground with armored, rocky shoreline through the marina to Fort Mason; then predominately urban waterfront along the remainder of the subregion through Aquatic Park, Fisherman's Wharf, and along The Embarcadero to the Bay Bridge, with multiple piers extending out into the bay.

Existing Seawater Pump Station No. 2 is located within this subregion near the northeast corner of Fort Mason at the north end of Van Ness Avenue, adjacent to Aquatic Park. Topographic cross-sections from the bay inland have been developed for two typical locations within this subregion, as shown in Figure 5-11 and Figure 5-12.

Almost anywhere within this subregion from Crissy Field eastward could be a potential location for a new seawater supply facility. Figure 5-10 shows the existing EFWS and planned PEFWS networks within the city and their proximity to this subregion.

A preferred location for a new seawater pump station should be considered as close as possible to the shoreline but outside of the 100-foot upland jurisdictional limits of the BCDC, the primary regulatory agency for actions within San Francisco Bay. Regardless of the pump station location, its intake from the bay would cross land regulated by the BCDC, so that entity will still be involved in the permitting process. In addition, a seawater supply facility located in the area from Crissy Field west to the Golden Gate Bridge would sit on federal land managed by the NPS or Presidio Trust as part of the GGNRA, so these two Federal agencies would be involved in this area.

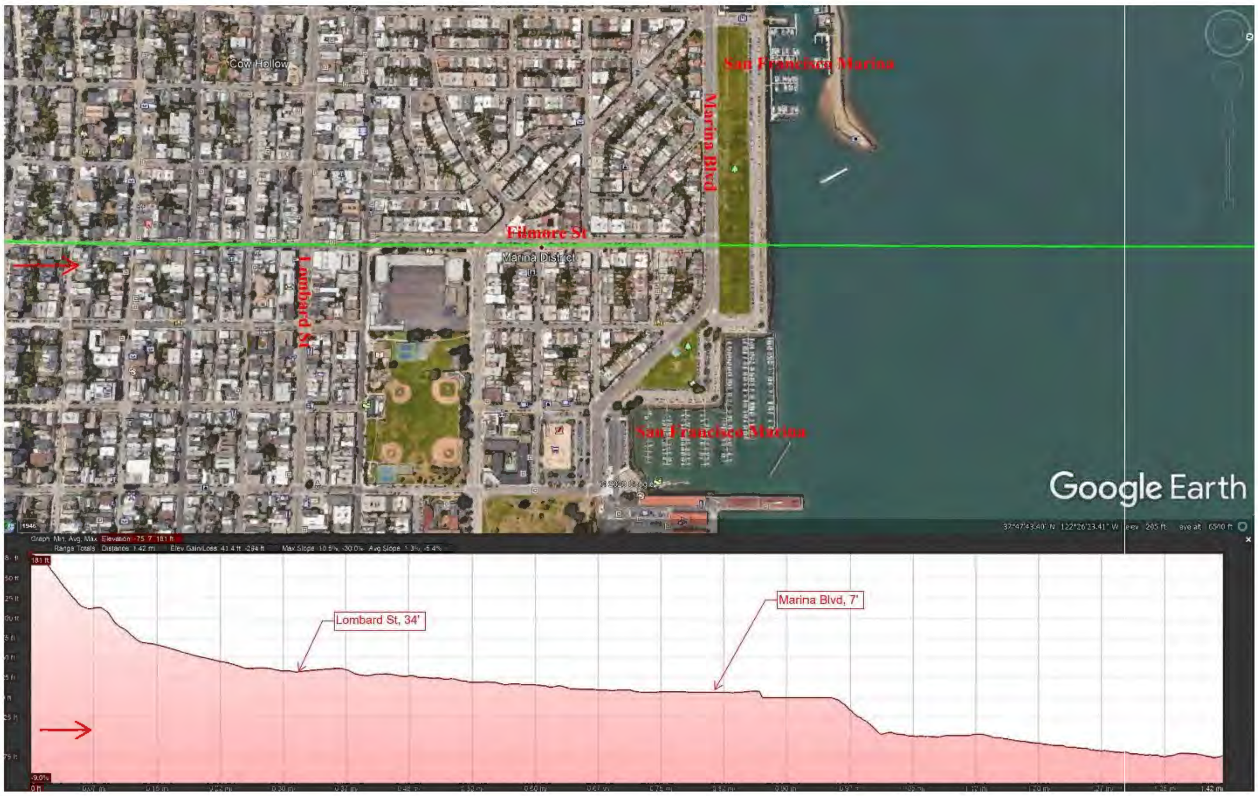


Figure 5-11: Typical Cross Section – Filmore Street

Figure 5-12: Typical Cross Section – Pier 9 Area

For a seawater supply facility located at Crissy Field, the nearest existing EFWS piping is in Baker Street near the Palace of Fine Arts, approximately 500 feet to 1.3 miles away along existing roads, depending on the site. This existing EFWS piping in this area is only 12-inch diameter. For the remainder of this subregion, the distance from the shoreline to the existing EFWS network is only a few hundred feet or less. The majority of the existing EFWS piping in this area is 10 or 14 inches in diameter, as shown in Figure 5-10.

As with the existing EFWS piping on the west side of the city, all EFWS piping in the vicinity of the connection point(s) may need to be upsized for some distance to accommodate the inflow from a new seawater supply facility.

Only an open-water intake is considered feasible along the bay, in either subregion. This is due primarily to the silty bottom of the bay which could severely limit the production of a slant well due to poor permeability. The BCDC also finds subsurface intake systems to be infeasible and prefers open-water intakes, so permitting a slant well in this area would be a significant challenge if pursued. Locating enough vacant land to construct multiple slant well arrays could also present a serious challenge.

5.2.2 East Bayfront Subregion

The East Bayfront subregion includes the area from the Bay Bridge south to the city limits near Candlestick Point. Figure 5-13 shows the portion of this subregion considered for a new seawater supply facility (circled in purple).

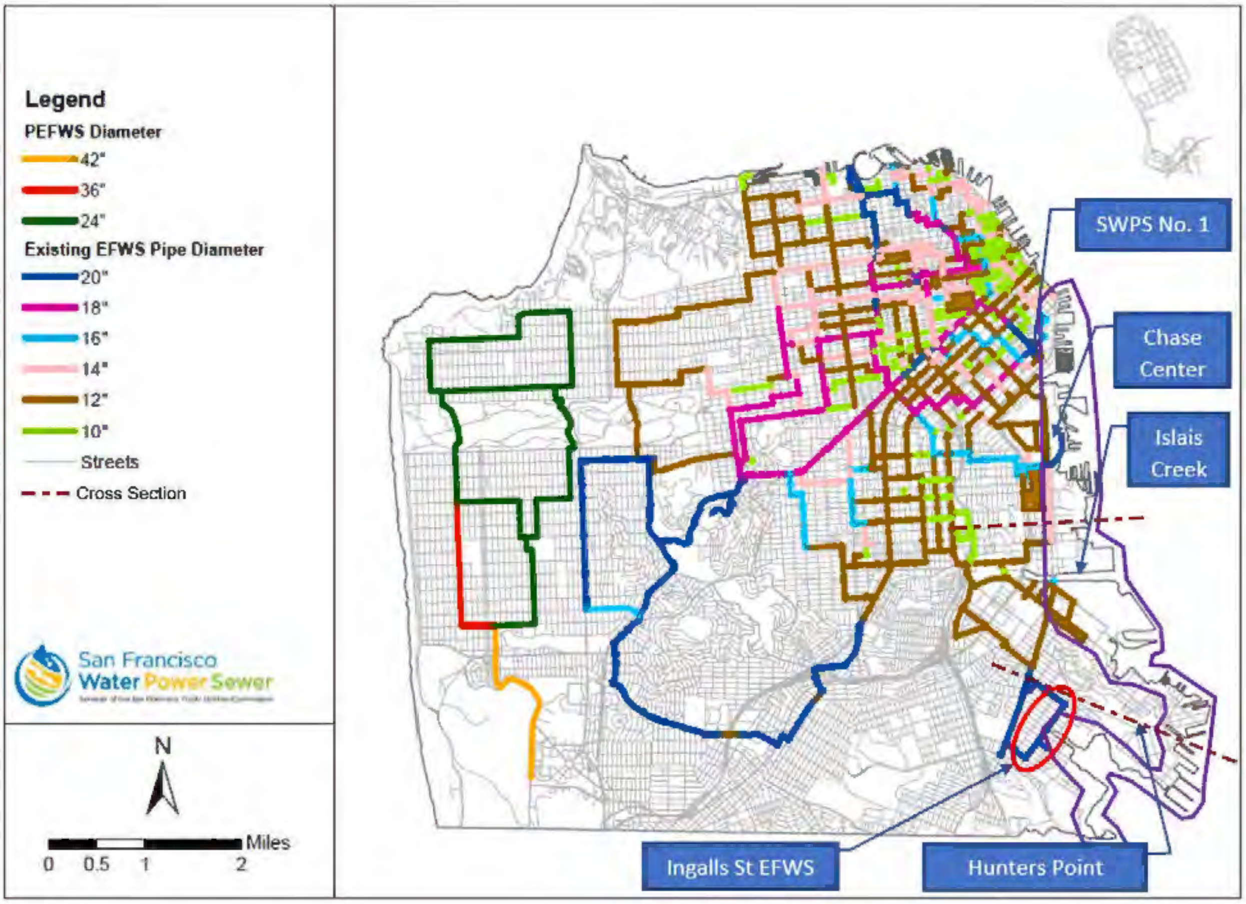


Figure 5-13: Potential Seawater Supply Locations – East Bayfront Subregion

The topography is like the North Bayfront subregion and is characterized as predominately urban and former heavy industrial waterfront. Most of the shoreline, especially on the southern end near Hunters Point and Candlestick Point, has been expanded outward into the bay over time from its original boundaries using fill material placed on top of bay mud.

Existing Seawater Pump Station No. 1 is located within this subregion underneath the SFFD Headquarters Building on the southwest corner of Townsend Street and 2nd Street. Topographic cross-sections from the bay inland have been developed for two typical locations within this subregion, as shown in Figure 5-14 and Figure 5-15.

Figure 5-14: Typical Cross Section – 23rd Street/Potrero Power Station Area

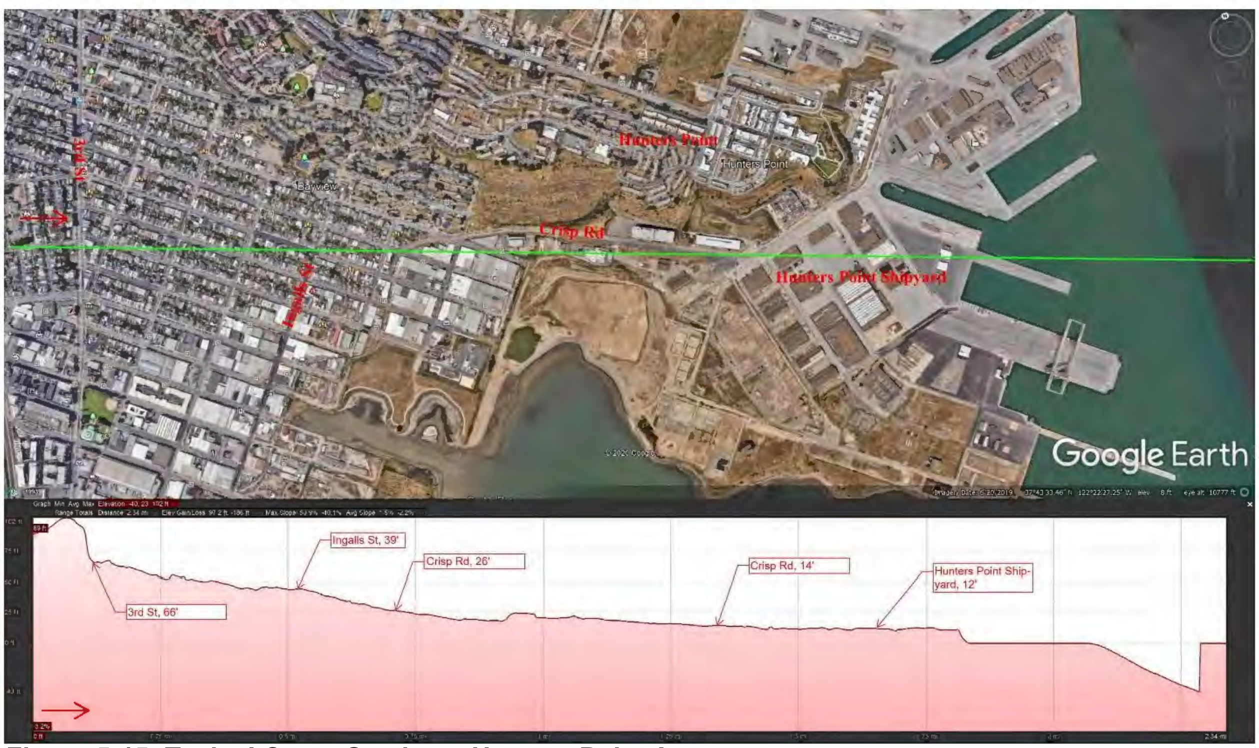


Figure 5-15: Typical Cross Section – Hunters Point Area

Almost anywhere within this subregion could be a potential location for a new seawater pump station. Figure 5-13 shows the existing EFWS and planned PEFWS networks within the city and their proximity to this subregion. It may not be quite as challenging to find available land to construct a new pump station in this subregion compared to the North Bayfront subregion. A preferred location should again be considered as close as possible to the shoreline but outside of the jurisdictional limits of the BCDC. Regardless of the pump station location, its intake from the bay would cross land regulated by the BCDC, so that entity will still be involved in the permitting process.

Much future redevelopment is planned for the Hunters Point and Candlestick Point areas, so it may make sense to locate at least one pump station in this vicinity to provide an additional firefighting water supply to service this growth.

The distance from the shoreline to the nearest existing EFWS piping varies greatly depending on location. In the area from the Bay Bridge south to Islais Creek, existing EFWS piping ranges from approximately 500 feet to 2,000 feet from the shoreline, with the distance generally increasing as one moves farther south. Most of the existing EFWS piping in this area is either 12 or 14 inches in diameter, with a few sections of 16- and 20-inch pipe near PS 1 and the Chase Center.

South of Islais Creek in the Hunters Point and Candlestick Point areas, the nearest existing EFWS piping varies from approximately 500 feet to 1.5 miles from the shoreline depending on location. This pipe is either 12 or 20 inches in diameter. The existing 20-inch EFWS pipe in Ingalls Street would be a likely connection point in this area due to its larger size and capacity.

The existing EFWS piping may need to be upsized near the connection point(s) and for some distance beyond to accommodate the additional inflow from a new seawater supply source. As with the other subregions, this would need to be evaluated by performing iterative hydraulic modeling on the EFWS network.

Chapter 6: Pump Station Concepts

This chapter presents existing engineering and operational aspects of the EFWS and prospective engineering design opportunities and challenges for a new pump station(s) in any of the five subregions analyzed.

6.1 Overview

New seawater pump stations, regardless of whether located at the Pacific Ocean or San Francisco Bay shoreline, would be anticipated to only tie into the existing high pressure EFWS network to provide additional water supply after a major seismic event.

Although it is supplied with potable water, the existing EFWS is considered a non-potable system. After use with seawater supplied by new (or the existing) pump stations, it is anticipated that the EFWS lines would need to be thoroughly flushed with potable water (or recycled water, if available) to expel the corrosive seawater from the pipe network.

It is anticipated that any new seawater pump stations will not connect to the future PEFWS network, which will contain potable water. The PEFWS will be designed with enough capacity to meet the projected post-large earthquake firefighting water demands and targeted supply reliability goals within the eight FRAs it will support on the west side of the city.

One or two large regional seawater pump stations could be constructed to meet the required demands, or multiple smaller pump stations could be built at strategic locations, as shown in Figure 6-1. An advantage of having multiple small pump stations would be the inherent redundancy of having distributed facilities.

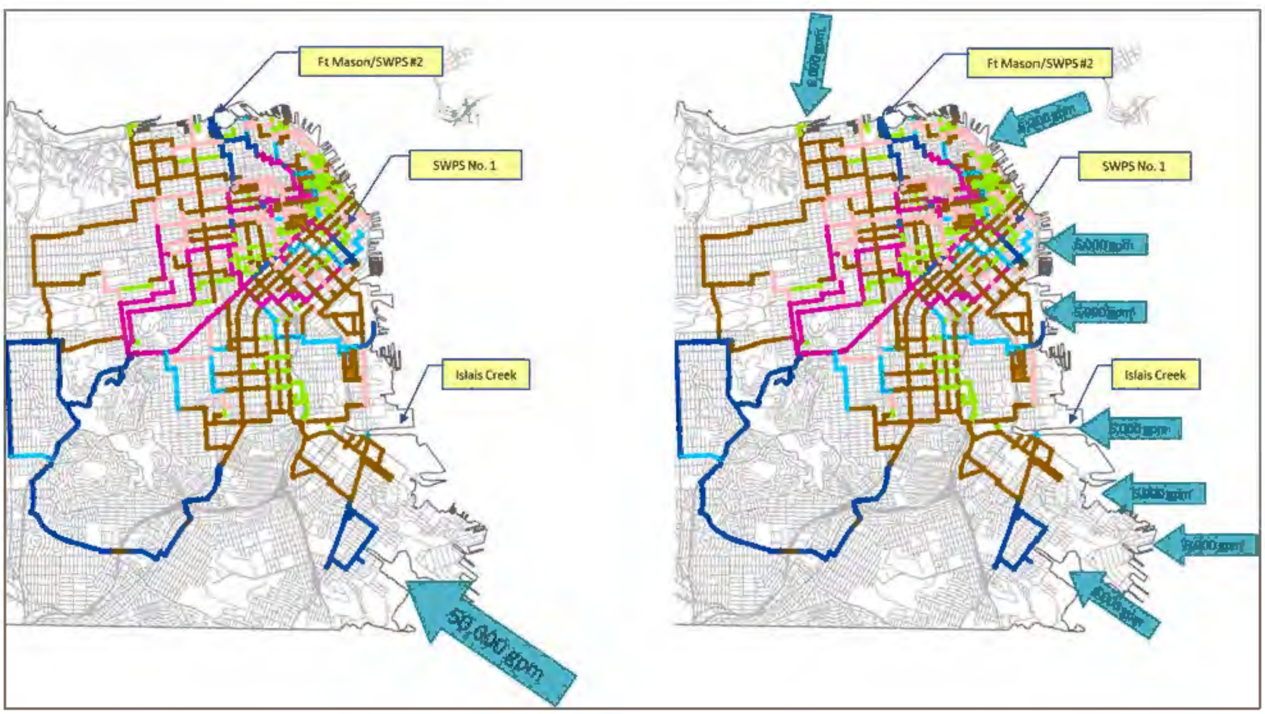


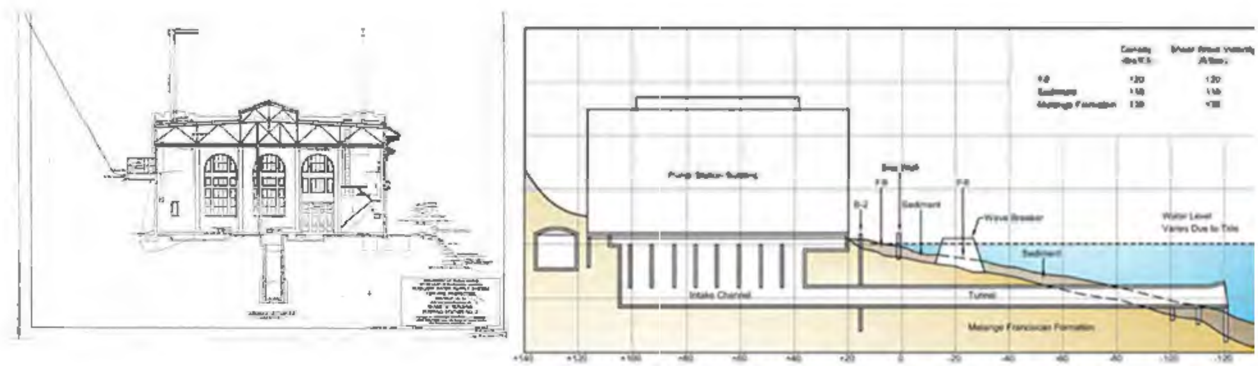
Figure 6-1: Single Large Pump Station vs. Multiple Smaller Pump Stations

Multiple smaller facilities would reduce the impact on the existing EFWS network by requiring less local "upsizing" of existing pipe due to smaller inflows; provide more flexibility by allowing the placement of pump stations close to FRAs with higher projected demands; and spread out the seawater inflows over a wider portion of the EFWS network.

Multiple pump stations are expected to cost more in total than one large pump station to provide the same total flow rates, and each would likely need to be permitted separately, possibly increasing the overall environmental and permitting level of effort (and cost) significantly.

6.2 General Configurations

New seawater pump stations could have general layouts and configurations like the existing PS1 and PS2 (which makes sense for large flow capacities), as shown in Figure 6-2, but could also have smaller configurations, similar to those used for the SFPUC Groundwater Supply Project, as shown in Figure 6-3.



Source: SFPUC Record Drawing *Source: AECOM/AGS (2013b)*

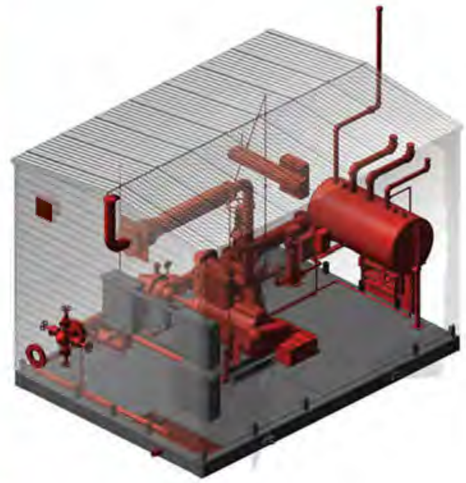
Figure 6-2: Existing Stormwater Pump Station 2

Source: http://www.sfwater.org/sfgroundwater

Figure 6-3: Existing Groundwater Supply Pump Station Buildings

Another option for new seawater pump stations could be the use of prefabricated or “package” pump systems, which can fit in the footprint of a semi-truck trailer. These can be configured for either open-air or enclosed applications, as shown in Figure 6-4.

Source: www.pattersonpumps.com



Source: www.armstrongintegrated.com

Figure 6-4: Examples of Package Pump Systems

6.3 Design Parameters

Preliminary design considerations have been developed for new seawater pump stations located within the five subregions of shoreline defined for this Study. These design considerations are listed in Table 6-1 and discussed in the sections below.

Information is included for pump station capacities ranging from 3,000 to 50,000 gpm. Appendix D shows conceptual layouts of seawater pump stations of these capacities.

For this study, it is assumed that one standby pump will be provided for redundancy for pump station capacities of 10,000 gpm and above. For 3,000 and 6,000 gpm capacity pump stations, it is assumed that no standby pumps will be provided.

For pump station capacities ranging from 20,000 gpm to 50,000 gpm, it is assumed that each individual pump has a capacity of 10,000 gpm, so the total capacity of the station can be increased by simply adding additional pumps (*i.e.*, a 40,000-gpm pump station has four primary duty pumps and one standby pump). For a 10,000 gpm capacity pump station, two 5,000 gpm pumps are assumed to be provided, while for 3,000 and 6,000 gpm capacity pump stations, only a single pump is assumed to be provided.

For this study, all pumps are assumed to be equipped with diesel engines as their primary driver. A small emergency generator would be provided to run the necessary electrical, communications, and security equipment at the pump station in event of a power outage following a large earthquake. Alternatively, the pumps could be equipped with electric motors with a larger diesel-powered generator to maintain operability during a power outage.

In addition to the information presented in Table 6-1, a summary of the existing geotechnical and geologic/seismic conditions and related hazards that could potentially be encountered at seawater pump stations within each subregion are presented in the sections below. A brief discussion of the potential future impacts of ongoing sea level rise near the shorelines is also included.

Table 6-1: Seawater Pump Station Preliminary Design Considerations

	Subregion	Pump Station Design Considerations by Subregion					Existing Seawater Pump Stations	
		Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	General Parameters							
	Normal EFWS Connection Pressure (pounds per square inch, psi)[11]	200	143	143	160	160	160	160
	Max. EFWS Connection Pressure (psi)[12]	200	234	268	328	328	328	328
	Min. Distance from Shore to High Pressure EFWS (mi)[3]	1.70	2.20	1.50	0.05	0.15 to 1.50	0.02	0.15
	Diameter of High Pressure EFWS Piping @ Closest Tie-In Inches (in.)	20	12	12	10 to 14	12 to 20	20	20
	Water Quality	Ocean	Ocean	Ocean	Bay	Bay	Bay	Bay
	Connection to Potable EFWS	Possible[1]	Possible[1]	Possible[1]	No	No	No	No
	Potential Intake Types	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Open Water[6]	Open Water[6]	Open Water	Open Water
	Frequency of Use[2,4]	After EQ only	After EQ only	After EQ only	After EQ only[4]	After EQ only[4]	After EQ only[4]	After EQ only[4]
	Flush EFWS Piping After Use	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Discharge Requirements vs. Capacity							
3,000 gpm	Discharge Pressure (psi)[5]	345 (or 344)	432 (or 404)	445 (or 464)	375 (or 374)	381 to 418	N/A	N/A
3,000 gpm	Discharge Pipe Inside Diameter (ID) (in.)[9,10]	18 (or 2X14)	14 (or 2X12)	14 (or 2X10)	12 (or 2X10)	12/14	N/A	N/A
3,000 gpm	Flow Velocity (fps)	3.73 (or 3.09)	6.17 (or 4.2)	6.17 (or 6.05)	8.4 (or 6.05)	8.4/6.17	N/A	N/A
3,000 gpm	Total Hydraulic Power (megawatts, MW)[13]	0.45	0.56	0.57	0.48	0.49 to 0.54	N/A	N/A
3,000 gpm	Hydraulic Power per Pump (MW)[14]	0.45	0.56	0.57	0.48	0.49 to 0.54	N/A	N/A
3,000 gpm	Hydraulic Power at EFWS Connection (MW)[15]	0.26	0.30	0.35	0.42	0.42	N/A	N/A
6,00	Discharge Pressure (psi)[5]	344 (or 345)	436 (or 432)	447 (or 445)	373 (or 373)	381 to 421	N/A	N/A

	Subregion	Pump Station Design Considerations by Subregion					Existing Seawater Pump Stations	
		Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	Discharge Pipe ID (in.)[9,10]	24 (or 2X18)	18 (or 2X14)	18 (or 2X14)	18 (or 2X14)	16/18	N/A	N/A
	Flow Velocity (fps)	4.2 (or 3.73)	7.47 (or 6.17)	7.47 (or 6.17)	7.47 (or 6.17)	9.45/7.47	N/A	N/A
	Total Hydraulic Power (MW)[13]	0.89	1.12	1.15	0.96	0.98 to 1.08	N/A	N/A
	Hydraulic Power per Pump (MW)[14]	0.89	1.12	1.15	0.96	0.98 to 1.08	N/A	N/A
	Hydraulic Power at EFWS Connection (MW)[15]	0.52	0.60	0.69	0.85	0.85	N/A	N/A
10,000 gpm[8]	Discharge Pressure (psi)[5,7]	342 (or 340)	410 (or 416)	474 (or 461)	374 (or 374)	380 to 403	291	293
10,000 gpm[8]	Discharge Pipe ID (in.)[9,10]	30 (or 2x24)	24 (or 2x18)	20 (or 2x16)	20 (or 2x16)	20/24	2x20	2x20
10,000 gpm[8]	Flow Velocity (fps)	4.48 (or 3.50)	7.00 (or 6.22)	10.08 (or 7.88)	10.08 (or 7.88)	10.08/7.00	5.45	5.45
10,000 gpm[8]	Total Hydraulic Power (MW)[13]	1.47	1.76	2.04	1.61	1.63 to 1.73	1.35	1.36
10,000 gpm[8]	Hydraulic Power per Pump (MW)[14]	0.74	0.88	1.02	0.80	0.82 to 0.86	0.34	0.34
10,000 gpm[8]	Hydraulic Power at EFWS Connection (MW)[15]	0.86	1.01	1.15	1.41	1.41	0.74	0.74
20,000 gpm	Discharge Pressure (psi)[5]	348 (or 342)	420 (or 410)	436 (or 474)	373 (or 375)	374 to 387 (or 375 to 403)	N/A	N/A
20,000 gpm	Discharge Pipe ID (in.)[9,10]	36 (or 2x30)	30 (or 2x24)	30 (or 2x20)	30 (or 2x20)	36 (or 2x24)	N/A	N/A
20,000 gpm	Flow Velocity (fps)	6.22 (or 4.48)	8.96 (or 7.00)	8.96 (or 10.08)	8.96 (or 10.08)	6.22 (or 7.00)	N/A	N/A
20,000 gpm	Total Hydraulic Power (MW)[13]	2.99	3.61	3.75	3.21	3.21 to 3.33	N/A	N/A
20,000 gpm	Hydraulic Power per Pump (MW)[14]	1.50	1.80	1.87	1.60	1.60 to 1.66	N/A	N/A
20,000 gpm	Hydraulic Power at EFWS Connection (MW)[15]	1.72	2.01	2.30	2.82	2.82	N/A	N/A
30,000 gpm	Discharge Pressure (psi)[5]	348 (or 355)	413 (or 397)	432 (or 465)	373 (or 374)	375 to 405 (or 379 to 438)	N/A	N/A
30,000 gpm	Discharge Pipe ID (in.)[9,10]	42 (or 2x30)	36 (or 2x30)	36 (or 2x24)	36 (or 2x24)	36 (or 2x24)	N/A	N/A
30,000 gpm	Flow Velocity (fps)	6.86 (or 6.72)	9.34 (or 6.72)	9.34 (or 10.50)	9.34 (or 10.50)	9.34 (or 10.50)	N/A	N/A

		Pump Station Design Considerations by Subregion					Existing Seawater Pump Stations	
	Subregion	Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	Total Hydraulic Power (MW)[13]	4.48	5.32	5.56	4.81	4.83 to 5.22	N/A	N/A
	Hydraulic Power per Pump (MW)[14]	1.49	1.77	1.85	1.60	1.61 to 1.74	N/A	N/A
	Hydraulic Power at EFWS Connection (MW)[15]	2.58	3.02	3.45	4.23	4.23	N/A	N/A
40,000 gpm	Discharge Pressure (psi)[5]	346 (or 348)	403 (or 420)	425 (or 437)	373 (or 373)	375 to 398 (or 376 to 410)	N/A	N/A
40,000 gpm	Discharge Pipe ID (in.)[9,10]	48 (or 2x36)	42 (or 2x30)	42 (or 2x30)	42 (or 2x30)	42 (or 2x30)	N/A	N/A
40,000 gpm	Flow Velocity (fps)	7.00 (or 6.22)	9.15 (or 8.96)	9.15 (or 8.96)	9.15 (or 8.96)	9.15 (or 8.96)	N/A	N/A
40,000 gpm	Total Hydraulic Power (MW)[13]	5.94	6.93	7.30	6.40	6.44 to 6.84	N/A	N/A
40,000 gpm	Hydraulic Power per Pump (MW)[14]	1.49	1.73	1.83	1.60	1.61 to 1.71	N/A	N/A
40,000 gpm	Hydraulic Power at EFWS Connection (MW)[15]	3.44	4.02	4.60	5.64	5.64	N/A	N/A
50,000 gpm	Discharge Pressure (psi)[5]	344 (or 343)	395 (or 399)	419 (or 422)	373 (or 373)	374 to 393 (or 374 to 395)	N/A	N/A
50,000 gpm	Discharge Pipe ID (in.)[9,10]	54 (or 2x42)	48 (or 2x36)	48 (or 2x36)	48 (or 2x36)	48 (or 2x36)	N/A	N/A
50,000 gpm	Flow Velocity (fps)	6.92 (or 5.72)	8.75 (or 7.78)	8.75 (or 7.78)	8.75 (or 7.78)	8.75 (or 7.78)	N/A	N/A
50,000 gpm	Total Hydraulic Power (MW)[13]	7.38	8.49	9.01	8.00	8.03 to 8.43	N/A	N/A
50,000 gpm	Hydraulic Power per Pump (MW)[14]	1.48	1.70	1.80	1.60	1.61 to 1.69	N/A	N/A
50,000 gpm	Hydraulic Power at EFWS Connection (MW)[15]	4.30	5.03	5.76	7.04	7.04	N/A	N/A

Notes:

1. Could connect to new PEFWS on west side of City (shorter distances), but this would preclude connecting to high pressure EFWS, which PEFWS will not connect to.
2. Assume also operate/test at least monthly to exercise pumps/appurtenances and ensure proper operation. Assume discharge of seawater back to source via test/recirculation piping.
3. Distances are approximate for a pump station located at or near the shoreline within each region. Also assumed 300 ft elevation increase from shore to high pressure EFWS connection points in Pacific Ocean region, 100 ft elevation increase in San Francisco Bay region.
4. Could also use for multiple alarm fires but would need to flush high pressure EFWS piping afterwards with potable (or possibly recycled) water.
5. Assume all piping is welded steel pipe with a maximum allowed pressure of 475 psi.
6. Slant wells generally not considered feasible due to silty bottom of SF Bay and regulatory challenges.

	Subregion	Pump Station Design Considerations by Subregion					Existing Seawater Pump Stations	
		Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2

7. Actual design discharge pressure for existing SWPS No. 1 and 2 is 300 psi.
8. Actual capacity of existing SWPS No. 1 and 2 is 10,800 gpm (4 pumps @ 2,700 gpm each).
9. Required discharge pipe size for single (or dual) discharge pipes. Corresponding required discharge pressure and flow velocity for dual discharge pipes shown in parenthesis.
10. Existing SWPS No. 1 and No. 2 both have dual 20" diameter discharge pipes.
11. Typical normal static EFWS connection pressure when piping in each zone (Lower, Upper, Twin Peaks) is supplied by its assigned reservoir (Jones St, Ashbury, Twin Peaks). Actual static pressure will depend on the connection location and elevation and could vary widely.
12. Typical maximum static EFWS connection pressure when all zones are supplied by Twin Peaks Reservoir. Actual maximum static pressure will depend on the connection location and elevation and could vary widely.
13. Required total hydraulic power output of pump station. Determined assuming all zones are supplied by Twin Peaks Reservoir.
14. Total hydraulic power/# of primary duty pumps. Assumed capacity of one pump per 10,000 gpm except for 10,000 gpm capacity pump station, which assumes two 5,000 gpm pumps. Only one pump assumed for 3,000 and 6,000 gpm capacity stations.
15. Hydraulic power at nearest connection to high pressure EFWS assuming all zones are supplied by Twin Peaks Reservoir.
16. Assume recirculation/test piping is same diameter as discharge piping (for discharges back to Ocean or SF Bay).

Subregion within Twin Peaks Zone, EFWS piping normally supplied from Twin Peaks Reservoir (10.5 million-gallon (MG) capacity, max. water surface elevation (WSE) = 758 ft.).
Subregion within Upper Zone, EFWS piping normally supplied from Ashbury Tank (0.5 MG capacity, max. WSE = 494 ft.).
Subregion within Lower Zone, EFWS piping normally supplied from Jones St. Tank (0.75 MG capacity, max. WSE = 369 ft.).

6.4 Pacific Ocean Region

This section provides a discussion of the preliminary engineering design considerations and other select topics for a future seawater pump station or multiple pump stations located along the Pacific Ocean coastline in San Francisco. This includes the Southern Dunes, Rocky Area South, and Rocky Area North subregions as shown in Figure 5-1.

6.4.1 Engineering Considerations

6.4.1.1 Southern Dunes Subregion

This subregion was described previously in Section 5.1.1. A seawater pump station located anywhere along Ocean Beach is anticipated to have the same or very similar geotechnical, seismic, and hydrogeologic conditions and be subject to the same natural hazards (*e.g.*, earthquake ground motions, tsunami inundation, liquefaction, flooding, sea level rise). Due to the elevation rise from the beach, a pump station at or near Fort Funston would be a less desirable location. The discharge piping from a pump station near this location would also need to be routed around Lake Merced, several public and private golf courses, and the San Francisco State University campus to connect into the nearest existing 20-inch diameter EFWS piping. This site would also be relatively close to the future planned Lake Merced Pump Station for PEFWS.

The engineering considerations for a seawater pump station along Ocean Beach are shown in Table 6-1 in the “Ocean/Southern Dunes” column. The nearest existing EFWS piping to this area runs north along Highway 1 (19th Ave) from Ulloa Street to Irving Street, just south of Golden Gate Park, as shown in Figure 5-2. The static pressure in this existing 20-inch diameter piping, which is within the Twin Peaks Zone of the EFWS fed by Twin Peaks Reservoir, ranges from approximately 140 to 236 psi, depending on location. The distance from Ocean Beach to the existing EFWS piping is approximately 1.70 miles, with a maximum elevation change of approximately 435 feet at Quintara Street east of Sunset Reservoir.

Both slant wells and open-water intake tunnels are considered feasible within this subregion. A drawback for slant wells is the number required to produce a desired flow rate. Preliminary estimates for slant well production along Ocean Beach based on a desktop review of available hydrogeologic data is approximately 3,000 gpm per well. For 10,000 gpm of total capacity, up to four slant wells would therefore be required. For 50,000 gpm of total capacity, up to 17 wells would be required.

Depending on the capacity of the seawater pump station (or combined capacity of the slant wells), recommended discharge pipe diameters to the existing EFWS network range from 18 inches for 3,000 gpm up to 54 inches for 50,000 gpm. It is also possible to split the discharge into two smaller diameter pipes (*e.g.*, two 24-inch-diameter pipes carrying 5,000 gpm each in lieu of one 30-inch-diameter pipe carrying 10,000 gpm). This would make it easier to tie into to the existing EFWS network hydraulically, which has a maximum pipe size of 20 inches. For a new seawater pump station or array of slant wells, it may be necessary to upsize the existing EFWS piping for some distance beyond the connection point(s) to accommodate the additional inflow.

Discharge pressure requirements for a seawater intake facility located near Ocean Beach are on the order of 350 psi for all capacities, discharge pipe sizes, or number of pipes, with flow velocities ranging from 3.7 to 7.0 feet per second (fps), as shown in Table 6-1. This is at the rated working pressure of 350 psi for ductile iron pipe (DIP), which is assumed to be used for discharge piping up to 24-inch diameter. Welded steel pipe (WSP) with the same minimum pressure rating is assumed to be used for discharge piping over 24-inches.

6.4.1.2 Rocky Area South Subregion

This subregion was described previously in Section 5.1.2. The very southern end of this subregion at Balboa Street may be a suitable location for a new seawater pump station as it has relatively easy access to Ocean Beach. Siting a pump station anywhere north of this area would be a greater challenge due to the cliffs and difficult terrain.

The engineering considerations for a seawater pump station in this area are shown in Table 6-1 in the "Ocean/Rocky Area South" column. The nearest existing EFWS piping to this area runs north along 12th Avenue from Cabrillo Street to California Street, as shown in Figure 5-5. The static pressure in this existing 12-inch-diameter piping, which is within the Upper Zone of the EFWS fed by the Asbury Tank, ranges from approximately 114 to 152 psi depending on location. Its distance is approximately 1.7 miles from Ocean Beach with a maximum elevation of approximately 230 feet at Balboa Street. After the Ashbury Tank empties, the existing EFWS piping in this subregion would be supplied from Twin Peaks Reservoir. In this event, the static pressure range at the EFWS connection point would increase to between approximately 228 and 266 psi, depending on location.

Both slant wells and an open-water intake tunnel are considered feasible near Balboa Street and the Great Highway. North of this area amongst the cliffs and bluffs only an open-water intake tunnel supplying a land-based seawater pump station would be considered feasible, but would likely be difficult and costly to construct, as discussed previously in Section 5.1.2.

Depending on the capacity of the seawater pump station or slant well array, recommended discharge pipe diameters range from 14 inches for 3,000 gpm up to 48 inches for 50,000 gpm. It is also possible to split the discharge into two smaller diameter pipes (*e.g.*, two 18-inch-diameter pipes carrying 5,000 gpm each in lieu of one 24-inch-diameter pipe carrying 10,000 gpm). This would allow multiple connections to the EFWS network with less expected negative impact to the existing piping at each connection. Even if the flow is split, it may be necessary to upsize the existing EFWS piping for some distance beyond the connection point(s) to accommodate the additional inflow, regardless of the tie-in location(s).

Discharge pressure requirements for a pump station or slant well array located near Balboa Street and the Great Highway range between approximately 395 and 436 psi for all capacities, discharge pipe sizes, or number of pipes with flow velocities ranging from 6.17 to 9.34 fps, as shown in Table 6-1. These values assume the existing EFWS piping is supplied by Twin Peaks Reservoir, as the Ashbury Tank would likely be drained quickly due to its relatively small capacity of 500,000 gallons. It is also assumed WSP will be used for all discharge piping within the subregion due to the high pressure requirements.

6.4.1.3 Rocky Area North Subregion

This subregion was described previously in Section 5.1.3. Baker Beach may be a feasible location for a new seawater pump station or slant well array in this subregion. The areas north and south of Baker Beach along the shoreline have a similar terrain to most of the Rocky Area South subregion with steep, rocky cliffs rising from a narrow, rocky beach with limited to no access. An exception is China Beach located just southwest of Baker Beach; however, China Beach is a much smaller beach with more limited and difficult access than Baker Beach.

The engineering considerations for a seawater pump station or slant well array in this subregion are shown in Table 6-1 in the "Ocean/Rocky Area North" column. The nearest existing EFWS piping to Baker Beach is the piping that runs north along 12th Avenue from Cabrillo Street to California Street, as shown in Figure 5-8. The static pressure in this existing 12-inch-diameter piping, which is also within the Upper Zone of the EFWS normally fed from the Ashbury Tank, ranges from approximately 114 to 152 psi depending on location. The distance from Baker Beach along existing roads to 12th Avenue is approximately 1.5 miles. The connection point would be anticipated to be at the north end of this segment near California Street. After the Ashbury Tank empties, the existing EFWS piping in this subregion would be supplied from Twin Peaks Reservoir. In this event, the static pressure range at the EFWS connection point would increase to between approximately 228 and 266 psi, depending on location.

Both slant wells and an open-water intake tunnel are considered feasible on Baker Beach. Outside of this area amongst the cliffs and bluffs, only an open-water intake tunnel would be considered feasible, just as in the Rocky Area South subregion.

Depending on the capacity of the seawater pump station or slant well array, recommended discharge pipe diameters range from 14 inches for 3,000 gpm up to 48 inches for 50,000 gpm. It is also possible to split the discharge into two smaller diameter pipes (*e.g.*, two 16-inch-diameter pipes carrying 5,000 gpm each in lieu of one 20-inch-diameter pipe carrying 10,000 gpm). This would allow multiple connections to the EFWS network with less expected negative impact to the existing piping at each connection. Even if the flow is split, it may be necessary to upsize the existing EFWS piping for some distance beyond the connection point(s) to accommodate the additional inflow regardless of the tie-in locations.

Discharge pressure requirements for a pump station or slant well array located at Baker Beach near Battery Chamberlain range between approximately 419 and 474 psi for all capacities, discharge pipe sizes, or number of pipes with flow velocities ranging from 6.17 to 10.08 fps, as shown in Table 6-1. These values assume the existing EFWS piping is supplied by Twin Peaks Reservoir, as the Ashbury Tank would likely be drained quickly due to its relatively small capacity of 500,000 gallons. It is also assumed WSP will be used for all discharge piping within the subregion due to the high pressure requirements.

6.4.2 Geologic and Geotechnical Considerations

Geotechnical and seismic induced hazards for facilities located along the Pacific Ocean coastline include liquefaction, landslides, tsunami runup, and seismic ground shaking. Factors influencing these hazards include geologic conditions, topography, groundwater levels, and distance to active faults.

The underlying geology of San Francisco is characterized by rock of Late Mesozoic or Early Cretaceous age covered by a variably thick sequence of Quaternary alluvial and eolian sediments as thick as 300 feet. The oceanside locations for the intake facilities would generally lie either in the beach and sand dune geologic unit along the Southern Dunes and Rocky Area North Subregions or Franciscan Complex sedimentary rocks of the Rocky Area South Subregion and portions of the Rocky Area North Subregion. The dune deposits cover most of the slopes and hills in western and northern San Francisco. The deposits occur mainly in large sheets, with beach sands mapped along the active Pacific and Golden Gate shorelines. These deposits consist of well sorted fine to medium-grained sand that is wave sorted and subject to shallow saline groundwater. The depth of bedrock is estimated to be greater than 60 feet along the Southern Dunes and Rocky Area North subregions. Franciscan rocks exposed in San Francisco range in age from Late Jurassic through Cretaceous age (165 to 65 million years old).

Historical groundwater depths in the oceanside region vary from 10 to 30 feet in the Southern Dunes and depths of 50 feet in the rocky areas. Given the high groundwater and soft sands, the Southern Dunes area is an area of potential liquefaction. Additionally, these soft materials can amplify seismic ground motions in the event of an earthquake. Based on the topography the rocky areas may be subjected to landslides.

Peak ground acceleration as a result of a moment magnitude (M) 7.8 on the San Andreas fault is estimated as 0.84 g along the Southern Dunes, 0.72 g along the Rocky Area South and 0.64 g in the Rocky Area North, at the 84th percentile level (AECOM/AGS, 2013a). Peak ground velocity is estimated as 4.0 to 3.3 fps along the Southern Dunes and 3.3 to 2.6 fps along the rocky areas, at the 84th percentile level (AECOM/AGS, 2013a).

The seismic induced hazards include settlements of the ground surface, lateral deformations, development of excess pore water pressure, buoyancy effects on below groundwater structures, loss of allowable bearing pressure, and increased lateral pressures on utilities and retaining structures extending below the groundwater table. Seismic-induced hazards may be mitigated through a program of ground improvement. Available techniques for soil improvement include vibro-replacement stone columns, deep soil mixing, and grouting techniques. Alternatively, liquefaction-induced settlements can be minimized by supporting structures on deep foundations.

6.4.3 Coastal Hazards and Sea Level Rise Considerations

Any new oceanside pump station facilities along the Southern Dunes, Rocky Area South, or Rocky Area North Subregions would need to consider potential coastal hazards in their siting and design. Coastal hazards include existing and future inundation and flooding from tides and storm surge, wave runup and overtopping, wind-blown sand, event-based storm erosion, and long-term shoreline change.

Existing coastal flood hazards along the Pacific coastline are delineated in Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) for the City and County of San Francisco. The FIRMs depict coastal hazards due to tides, storm surge, wave runup, wave overtopping, and event-based dune erosion. The FIRMs do not depict hazards from seasonal and inter-annual beach width fluctuations, wind-blown sand, event-based bluff or cliff erosion, and long-term shoreline change. Any facility constructed within the coastal zone would likely require a site-specific study to evaluate the potential for these additional hazards to impact the facility over its anticipated lifespan.

Future coastal flood hazards along the Pacific coastline have been evaluated by the U.S. Geological Survey (USGS) and FEMA for the City and County of San Francisco. Both datasets provide projections of future flood and erosion hazards along the Pacific coastline and can be used to perform high-level assessments of potential future coastal hazards for planning level analyses and site assessments. The USGS (Barnard, *et al.* 2020) evaluated future storm-induced coastal flooding and erosion along the Pacific coastline using the Coastal Storm Modeling System (CoSMoS) tool. Digital hazard layers are available online from the USGS website[2]. In addition, FEMA conducted a sea level rise and shoreline change pilot study in San Francisco (AECOM, 2016) that mapped the projected extent of the Special Flood Hazard Area (including the effects of sea level rise and long-term shoreline change). Both consider projected sea level rise and shoreline change through 2100.

At the local level, the City and County of San Francisco provides additional guidance on the incorporation of sea level rise considerations into City capital projects through its Guidance for Incorporating Sea Level Rise into Capital Planning[3]. The City's Sea Level Rise Vulnerability Zone (Figure 6-5) identifies areas of the City that may be exposed to sea level rise related hazards through 2100. Projects that fall within this zone with costs exceeding $5 million are required to complete the City's Sea Level Rise Checklist, which guides the project team through a standardized process to identify and evaluate potential sea level rise related vulnerabilities and risks to the project.

[2] https://www.sciencebase.gov/catalog/item/5b280118e4b0592076260491
[3] https://onesanfrancisco.org/sea-level-rise-guidance

Figure 6-5: San Francisco Sea Level Rise Vulnerability Zone

Strategies to address existing and future coastal hazards to oceanside pump station facilities would likely include hazard avoidance (*e.g.*, locating pump stations beyond the landward limit of potential future coastal hazards) or protection (*e.g.*, locating pump stations behind existing or new coastal protection structures such as seawalls). Site modifications to landside facilities such as raising site elevations, elevating critical electrical and mechanical equipment above projected future flood elevations, or floodproofing buildings or equipment enclosures would also mitigate future flood risks.

6.4.4 Operation and Maintenance

Operation and maintenance practices for new seawater pump stations located in the Pacific Ocean region should include the following items at a minimum:

- All pumps and motors should be exercised regularly (*e.g.*, monthly) to ensure their proper operation.
- After each use, the pumps and all inlet and outlet piping should be flushed thoroughly with potable or recycled water to the extent possible to expel corrosive seawater from the pipes.
- Fuel for diesel engines should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.
- Motor oil and other critical engine fluids should be checked and changed regularly. Air intakes and exhaust manifolds should also be regularly inspected and maintained in good condition.

- Emergency generators should be operated periodically (*e.g.*, monthly) to ensure their proper operation. Fuel should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.
- Sites should be well maintained and kept free from accumulated trash, debris, weeds, graffiti, blown sand, *etc.* Unencumbered access should always be maintained (*e.g.*, entrance gates not blocked by parked vehicles, *etc.*). Building interiors should also be maintained in a clean, uncluttered, and safe condition.
- Security systems should be checked and tested regularly to ensure proper operation.
- All metallic components (visible piping and valves, motors, electrical cabinets, *etc.*) should be regularly inspected for corrosion and refinished or repaired as necessary. Protective coatings should be maintained to prolong service life of equipment.

6.4.5 Security Considerations

As at all SFPUC facilities, security at each pump station site or slant well array wellhead enclosure will be essential. It is assumed that all sites will be well lit, fully alarmed and monitored, and have multiple motion-activated and infrared capable pan-tilt-zoom surveillance cameras. Sites will also be surrounded by a perimeter security wall or fencing with remote or keycard access unless they are incorporated into a public park, open space, *etc.* and fencing is not aesthetically desired. Other security features, such as an invisible electronic barrier set inside the perimeter fencing that is tripped by a person or large object crossing it, could also be considered. In addition to triggering the alarm, this barrier would also be integrated with the surveillance cameras. When the barrier is tripped, the nearest camera(s) would be triggered and would focus on the violated zone to capture and record the event. This would provide a “belt-and-suspenders” approach in the event a person was able to scale the fence or wall and initially slip past the surveillance cameras undetected. All security features would be capable of being operated by emergency generator or uninterruptable power supply inside the pump station building or wellhead enclosure in the event of a temporary power outage.

6.5 San Francisco Bay Region

This section provides a discussion of the preliminary engineering design considerations and other select topics for a future seawater pump station or multiple pump stations located along the San Francisco Bay shoreline in San Francisco. This includes both the North Bayfront and East Bayfront subregions as shown in Figure 5-1.

6.5.1 Engineering Considerations

6.5.1.1 North Bayfront Subregion

This subregion was described previously in Section 5.2.1. Most of this subregion from Crissy Field eastward could be a good potential location for a new seawater pump station. Existing SWPS No. 2 is already located in this subregion near the northeast corner of Fort Mason.

The engineering considerations for a seawater pump station in this subregion are shown in Table 6-1 in the “SF Bay/North Bayfront” column. There is existing EFWS piping near the shoreline throughout this entire area east of Crissy Field to the Bay Bridge, as shown in Figure 5-10. Most of this existing piping is either 10, 12, or 14 inches in diameter, depending on location, with some 20-inch pipe near SWPS No. 2. The static pressure in this piping, which is within the Lower Zone of the EFWS fed by the Jones Street Tank, is approximately 160 psi. The distance from the shoreline to the existing piping is only a few hundred feet or less with minimal elevation gain. After the Jones Street Tank empties, the existing EFWS piping in this subregion would be supplied from Twin Peaks Reservoir. In this event, the static pressure at the EFWS connection points would increase to approximately 328 psi.

As has noted previously, only open-water intakes are considered feasible to supply a new seawater pump station along San Francisco Bay in either subregion due primarily to the unfavorable hydrogeologic conditions for slant wells.

Depending on the capacity of the seawater pump station, recommended discharge pipe diameters range from 12 inches for 3,000 gpm up to 48 inches for 50,000 gpm. It is also possible to split the discharge from the pump station into two smaller diameter pipes (*e.g.*, two 16-inch-diameter pipes carrying 5,000 gpm each in lieu of one 20-inch-diameter pipe carrying 10,000 gpm). This would allow multiple connections to the EFWS network with less expected negative impact to the existing piping at each connection. Even if the flow is split, it may be necessary to upsize the existing EFWS piping in the vicinity of the connection(s) and for some distance beyond to accommodate the additional inflow, regardless of the tie-in locations.

Discharge pressure requirements for a new pump station located along the shoreline have a very narrow range of approximately 373 to 375 psi for all capacities, discharge pipe sizes, or number of pipes, while flow velocities range from approximately 7.47 to 10.08 fps depending on pipe size and discharge rate, as shown in Table 6-1. These values assume the existing EFWS piping is supplied by Twin Peaks Reservoir, as the Jones Street Tank, like the Ashbury Tank in the Upper Zone, would likely be drained quickly due to its relatively small capacity of 750,000 gallons. It is also assumed WSP will be used for all discharge piping within the subregion due to the high pressure requirements.

6.5.1.2 East Bayfront Subregion

This subregion was described previously in Section 5.2.2. Most of this subregion could be a potential location for a new seawater pump station. Existing SWPS No. 1 is also within this subregion underneath the SFFD Headquarters Building near Oracle Park.

The engineering considerations for a seawater pump station in this area are shown in Table 6-1 in the "SF Bay/East Bayfront" column. The distance from the shoreline to the nearest existing EFWS piping varies greatly depending on location. In the area from the Bay Bridge south to Islais Creek, the distance from the shoreline to existing EFWS piping ranges from approximately 500 feet to 2,000 feet, with the distance generally increasing as one moves farther south. Most of the existing EFWS piping in this area is either 12 or 14-inches in diameter, with a few sections of 16- and 20-inch pipe near SWPS No. 1 and the Chase Center. South of Islais Creek in the Hunters Point and Candlestick Point areas, the distance from the shoreline to the nearest existing EFWS piping varies from approximately 500 feet to 1.5 miles. This pipe is either 12 or 20 inches in diameter. The static pressure in the existing piping, which is within the Lower Zone of the EFWS fed by the Jones Street Tank, is approximately 160 psi, depending on its distance from the shoreline (pressure generally decreases as one moves farther inland). After the Jones Street Tank empties, the existing EFWS piping in this subregion would be supplied from Twin Peaks Reservoir. In this event, the static pressure at the EFWS connection points would increase to approximately 328 psi, same as in the North Bayfront Subregion.

As with the North Bayfront subregion, only open-water intakes are considered feasible to supply a new seawater pump station in this subregion.

Depending on the capacity of the seawater pump station and the distance to nearest existing EFWS piping from the shoreline, recommended discharge pipe diameters range from 20 or 24 inches for 10,000 gpm (20 inches for short distances, 24 inches for longer distances) up to 48 inches for 50,000 gpm. As with pump stations in the other subregions, it is possible to split the discharge from the pump station into two smaller diameter pipes (*e.g.*, two 16-inch-diameter pipes carrying 5,000 gpm each in lieu of one 20-inch-diameter pipe carrying 10,000 gpm). This would allow multiple connections to the EFWS network with less expected negative impact to the existing piping at each connection. It may be necessary to upsize the existing EFWS piping in the vicinity of the connection(s) and for some distance beyond to accommodate the additional inflow

Discharge pressure requirements for a new seawater pump station located in this subregion range between approximately 374 and 421 psi for all capacities, discharge pipe sizes, or number of pipes, while flow velocities range from approximately 6.17 to 10.08 fps, depending on pipe size and discharge rate, as shown in Table 6-1. These values assume the existing EFWS piping is supplied by Twin Peaks Reservoir, as the Jones Street Tank, like the Ashbury Tank in the Upper Zone, would likely be drained quickly due to its relatively small capacity of 750,000 gallons. It is also assumed WSP will be used for all discharge piping within the subregion due to the high pressure requirements.

6.5.2 Geologic and Geotechnical Considerations

Geotechnical and seismic induced hazards for facilities located along San Francisco Bay include liquefaction, landslides, tsunami runup and seismic ground shaking. Factors influencing these hazards include geologic conditions, topography, groundwater levels, and distance to active faults.

The underlying geology of San Francisco is characterized by rock of Late Mesozoic or Early Cretaceous age covered by a variably thick sequence of Quaternary alluvial and eolian sediments, as thick as 300 feet. The bayside locations for the intake facilities lie in regions with beach and dune sand geologic units or bay muds and artificial fill. Younger Bay Muds are around the shore of the San Francisco Bay and mostly covered by artificial fill. The thickness of the Younger Bay Mud is variable from 10 to 70 feet around the San Francisco Bay. The Younger Bay Mud is soft or very soft, organic-rich clay to silty clay; and often containing numerous clam shells. Most of the artificial fill was non-engineered. The fill was often placed directly over Bay Mud with a consistency and density that is highly variable. The depth of bedrock is estimated to be greater than 60 feet along most of the bayside.

Historical groundwater depths are 5 to 10 feet in the North and East Bayfront subregions. Given the high groundwater, younger Bay muds and artificial fill, the North and East Bayfronts are an area of potential liquefaction. Additionally, these soft materials can amplify seismic ground motions in the event of an earthquake.

Peak ground acceleration due to a moment magnitude (M) 7.8 on the San Andreas fault is estimated as 0.60 to 0.45 g along the North and East Bayfront subregions, at the 84^{th} percentile level. Peak ground velocity is estimated as 2.6 to 1.5 fps along the North and East Bayfronts, at the 84^{th} percentile level (AECOM/AGS, 2013a).

The seismic induced hazards include settlements of the ground surface, lateral deformations, development of excess pore water pressure, buoyancy effects on below groundwater structures, loss of allowable bearing pressure, and increased lateral pressures on utilities and retaining structures extending below the groundwater table. Seismic-induced hazards may be mitigated through a program of ground improvement. Available techniques for soil improvement include vibro-replacement stone columns, deep soil mixing, and grouting techniques. Alternatively, liquefaction-induced settlements can be minimized by supporting structures on deep foundations.

6.5.3 Coastal Hazards and Sea Level Rise Considerations

Any new bayside pump station facilities along the North and East Bayfront subregions would need to consider potential coastal hazards in their siting and design. Coastal hazards include existing and future inundation and flooding from tides and storm surge and wave runup and overtopping. Shoreline erosion is less of a concern along the bay shoreline than the Pacific coastline since most of San Francisco's bay shoreline is armored; however, any supporting landside facilities located along unarmored portions of the shoreline should consider the potential for erosion.

Existing coastal flood hazards along the Bay shoreline are delineated in Flood Insurance Rate Maps (FIRMs) prepared by the Federal Emergency Management Agency (FEMA) for the City and County of San Francisco. The FIRMs depict coastal hazards due to tides, storm surge, wave runup, and wave overtopping.

Future coastal flood hazards along the Pacific coastline have been evaluated by the U.S. Geological Survey (USGS)[4] and San Francisco Bay Conservation and Development Commission (BCDC)[5] for the City and County of San Francisco. Both datasets provide projections of future flood hazards (permanent inundation due to daily high tides and temporary flooding due to storm surge events) along the Bay shoreline and can be used to perform high-level assessments of potential future coastal hazards for planning level analyses and site assessments.

At the local level, the City and County of San Francisco's Guidance for Incorporating Sea Level Rise into Capital Planning would also apply to landside facilities located within the City's Sea Level Rise Vulnerability Zone, as described in Section 6.4.3.

Strategies to address existing and future coastal hazards to bayside pump station facilities would likely include hazard avoidance (*e.g.*, locating landside facilities beyond the landward limit of potential future inundation and flooding) or protection (*e.g.*, locating landside facilities behind existing or new coastal protection structures such as seawalls). Site modifications to landside facilities such as raising site elevations, elevating critical electrical and mechanical equipment above projected future flood elevations, or floodproofing buildings or equipment enclosures would also mitigate future flood risks.

6.5.4 Operations and Maintenance

Operation and maintenance practices for new seawater pump stations located in the San Francisco Bay region are the same as in the Pacific Ocean region and should include the following items at a minimum:

- All pumps and motors should be exercised regularly (*e.g.*, monthly) to ensure their proper operation.
- After each use, the pumps and all inlet and outlet piping should be flushed thoroughly with potable or recycled water to the extent possible to expel corrosive seawater from the pipes.
- Fuel for diesel engines should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.
- Motor oil and other critical engine fluids should be checked and changed regularly. Air intakes and exhaust manifolds should also be regularly inspected and maintained in good condition.
- Emergency generators should be operated periodically (*e.g.*, monthly) to ensure their proper operation. Fuel should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.
- Sites should be well maintained and kept free from accumulated trash, debris, weeds, graffiti, *etc.* Unencumbered access should always be maintained (*e.g.*, entrance gates not blocked by parked vehicles, *etc.*). Building interiors should also be maintained in a clean, uncluttered, and safe condition.
- Security systems should be checked and tested regularly to ensure proper operation.

[4] http://ourcoastourfuture.org/
[5] https://www.adaptingtorisingtides.org/maps-and-data-products/

- All metallic components (visible piping and valves, motors, electrical cabinets, *etc.*) should be regularly inspected for corrosion and refinished or repaired as necessary. Protective coatings should be maintained to prolong service life of equipment.

6.5.5 Security Considerations

Security considerations and facilities will be similar for all new seawater supplies for the EFWS, whether located within the Pacific Ocean region or the San Francisco Bay region. General security considerations for onshore pump stations are discussed in Section 6.2.5. A floating pump station as described in Section 2 may have additional security considerations, including a security perimeter on the floating portion of the pumping barge.

Chapter 7: Intake Concepts

This chapter presents engineering, operation and maintenance elements of prospective seawater intake systems that could support an expanded EFWS, including geological and coastal hazards, hydrogeological factors, as well as security considerations within each of the five subregions analyzed.

7.1 Overview

There are two types of intakes being considered for this study to supply seawater to the existing EFWS network that could be constructed by SFPUC in the future: (1) open-water intakes and (2) slant wells. Both are discussed in the sections below.

The California Ocean Plan in general requires subsurface seawater intakes (assuming they are feasible), rather than open water intakes. If subsurface intakes are not feasible, open water intakes must be screened to reduce entrainment of marine life. This generally requires screens with openings less than 1.0 mm, to prevent entrainment of small aquatic organisms. To minimize impingement of marine life on open water intake screens, the through-screen velocity must generally be less than 0.5 feet per second. Similar criteria exist for open water intakes in San Francisco Bay.

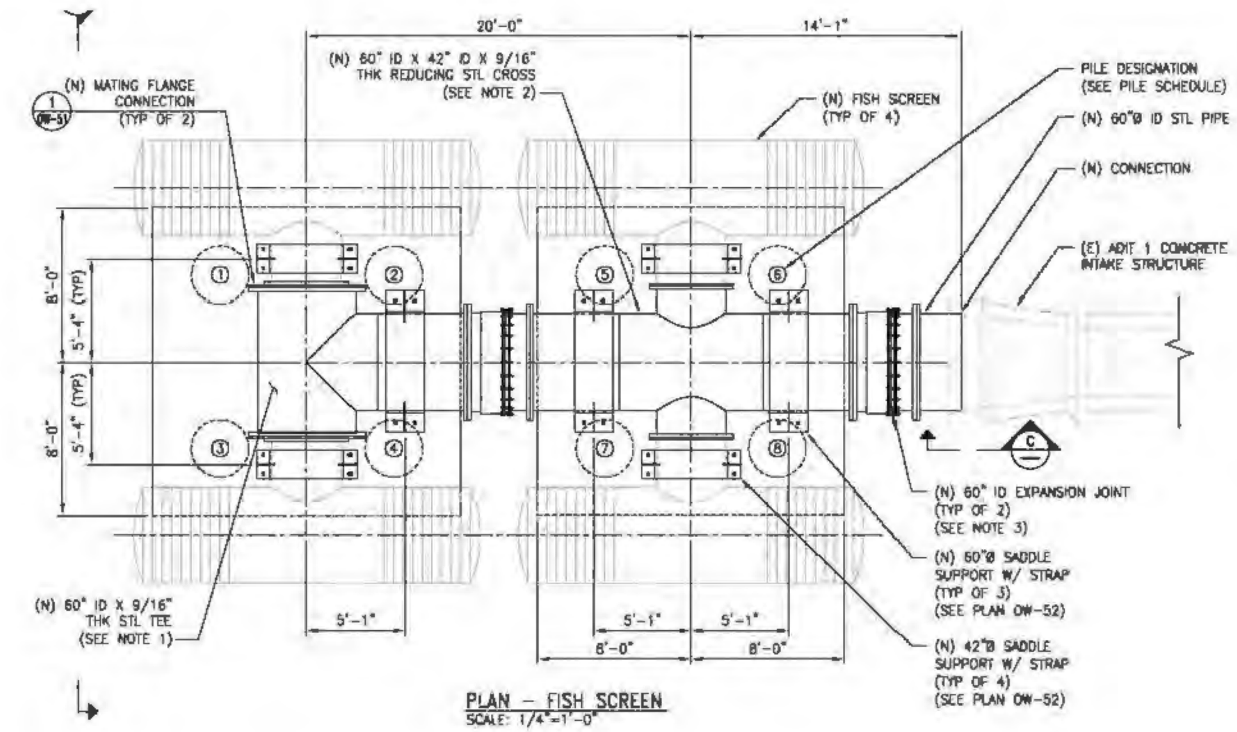
For either the ocean or bay sides of the City, consideration will be required for site-specific oceanic conditions. San Francisco Bay and the Golden Gate areas of the shoreline are subject to strong currents and sediment migration (Barnard, *et al.*, 2006). The intakes of PS1 and PS2 have historically required dredging due to sand accumulation, and the potential for this issue will need to be considered in siting any new pump stations.

7.1.1 Open-Water Intakes

An open-water intake is essentially a large pipe or conduit installed underwater with its inlet located above the seafloor or lakebed. The inlet is usually covered with one or multiple self-cleaning, stainless steel screens in a variety of configurations to prevent entrainment or impingement of aquatic life, underwater vegetation, trash, or debris.

A common in-parallel multiple screen configuration is shown in Figure 7-1 and Figure 7-2. In these figures, each double-sided “barrel” section is considered one screen (total of four screens shown). Figure 7-3 shows similar screens installed in a vertical configuration. In this arrangement, the screens are installed on rails or channels that allow them to be lowered and raised. This enables the screens to be raised out of the water as needed for cleaning and maintenance or to be stowed while not being used, or to be set at specific depths below the water surface.

Existing SWPS Nos. 1 and 2 both employ 60-inch-diameter reinforced concrete pipe open-water intake tunnels that extend into San Francisco Bay just beyond the existing seawall. The length of the intake tunnel for SWPS No. 1 is approximately 1,100 feet while the intake tunnel length for SWPS No. 2 is approximately 160 feet. Both tunnels have flared entrances on their inlets and per the as-built drawings the openings are covered by a single cast-iron bar screen with 3/4-inch spacing between bars.



Source: SFPUC Calaveras Dam Replacement Project

Figure 7-1: Example of Intake Screens on Open-Water Intake Tunnel

Source: SFPUC Calaveras Dam Replacement Project

Figure 7-2: Completed Intake Screens on Open-Water Intake Tunnel

Source: SFPUC Alameda Creek Diversion Dam Fish Passage and Screening Improvements

Figure 7-3: Intake Screens at Alameda Creek Diversion Dam

7.1.2 Slant Wells

Slant wells are essentially groundwater wells installed at an angle, typically around 20 degrees from horizontal. They contain submersible pumps and motors to pump the water into a distribution system, storage facility, or other destination such as a water treatment plant. They are constructed near the shoreline with the well screen extending partially underneath the adjacent water body. A conceptual section view of a slant well along Ocean Beach within the Southern Dunes subregion is shown in Figure 7-4. Figure 7-5 shows a photograph of the installation of a slant well in Monterey Bay, CA. A detailed section view of this slant well depicting the local aquifers is shown in Appendix C. This well was successfully installed by California American Water Company (CalAm) within a similar ocean dune setting to Ocean Beach.

The slant wells constructed for the CalAm project will not be housed in buildings but will be in below-ground vaults within fenced sites, with above ground electrical equipment. For slant wells constructed to supply seawater to the EFWS in San Francisco, it is assumed that the wells and electrical equipment will be fully enclosed in a building for added security and protection. A conceptual layout of a slant well building housing three slant wells is shown in Appendix D. Slant wells are a proven technology and have been utilized in numerous locations around the world. They are commonly used as intakes for reverse osmosis desalination facilities located on ocean coastlines, as proposed in the CalAm project.

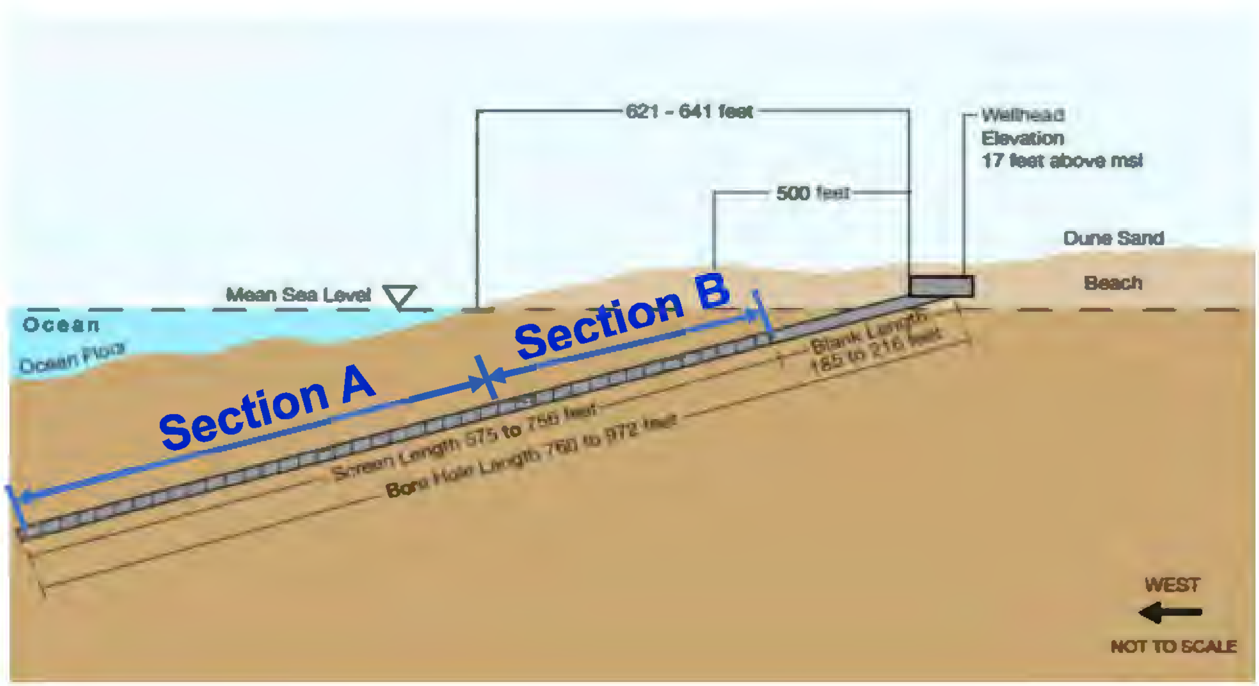
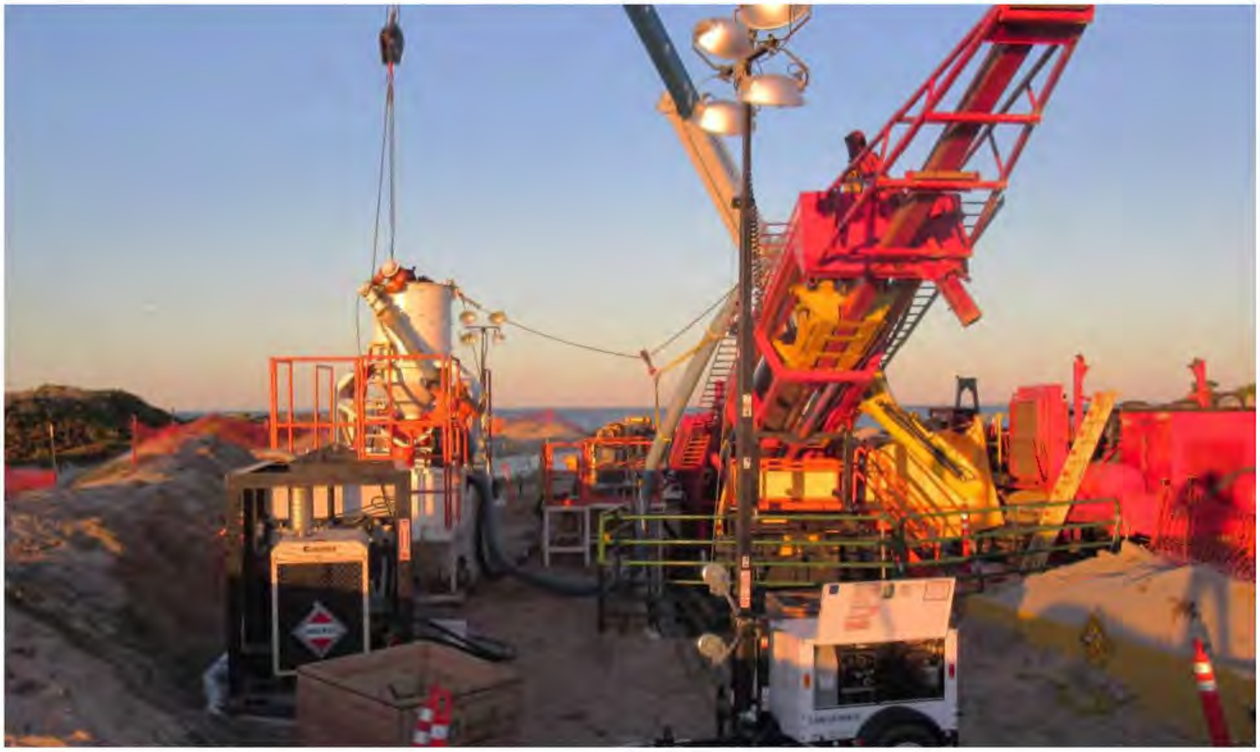


Figure 7-4: Conceptual Slant Well at Ocean Beach



Source: CalAm Monterey Peninsula Water Supply Project

Figure 7-5: Slant Well Installation

At most locations, multiple slant wells are generally required to provide a desired design flow rate to the destination facility because of their somewhat limited production. Figure 7-6 depicts commonly used methods to group multiple slant wells together. All wells in one of these arrays would discharge into a common discharge header with a single outlet pipe carrying the combined flow to the destination facility or distribution pipe network. The submersible well pumps would provide sufficient head to convey the extracted seawater to the destination.

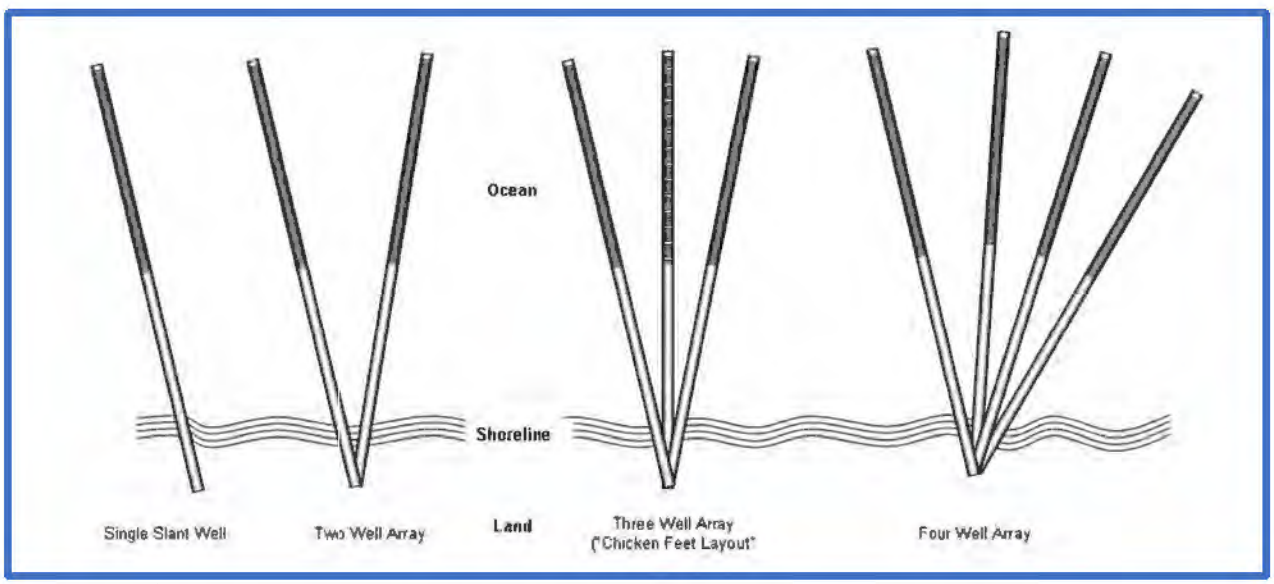


Figure 7-6: Slant Well Installation Arrays

A conceptual layout of slant wells along Ocean Beach that could supply up to 50,000 gpm is shown in Figure 7-7.

Figure 7-7: Conceptual Layout of Slant Wells at Ocean Beach

7.1.3 Intake Selection Considerations

For a new seawater supply facility located near the Pacific Ocean coastline in San Francisco, both slant wells and open-water intakes are in general deemed feasible from an engineering perspective. This includes the Southern Dunes, Rocky Area South, and Rocky Area North subregions of this study. However, within certain areas of each subregion, only one type of intake may be considered feasible based on the geology or other reasons.

For a new seawater supply facility located near the San Francisco Bay shoreline, only an open-water intake is considered feasible, primarily due to the silty bottom of the bay which could severely limit the production of slant wells due to low soil permeability.

Preliminary design considerations have also been developed for seawater intakes located within the five subregions. These design considerations are listed in Table 7-1 and discussed in the sections below.

7.1.4 Other Considerations

A summary of the existing geotechnical and geologic/seismic conditions and related hazards along with a brief discussion of the potential future impacts of sea level rise near the coastline are presented in the sections below. These conditions are expected to be the same or very similar as those described in Chapter 6 for seawater pump stations within each region. Additionally, Section 7.2.4 briefly describes the hydrogeology of the Pacific Ocean coastline and its anticipated relationship with slant wells. A discussion of the hydrogeology of the San Francisco Bay shoreline is not included since slant wells are not considered feasible in that region.

7.2 Pacific Ocean Region

This section provides a discussion of the preliminary engineering design considerations and other select topics for intakes to support future seawater supply facilities located along the Pacific Ocean coastline in San Francisco. This includes the Southern Dunes, Rocky Area South, and Rocky Area North subregions as shown in Figure 5-1.

7.2.1 Engineering Considerations

7.2.1.1 Southern Dunes Subregion

Both slant wells and open-water intakes are considered feasible in this area. Per the Ocean Plan and CCC policy regarding seawater intake systems, the use of subsurface intakes, such as slant wells for ocean intakes, is strongly preferred over open-water intakes. A drawback for slant wells is the number required to produce large flows. Preliminary estimates for slant well production along Ocean Beach (based on a desktop review of available hydrogeologic data) is approximately 3,000 gpm per well. For 10,000 gpm of total capacity, up to four slant wells would therefore be required. For 50,000 gpm of total capacity, up to 17 wells would be required.

Table 7-1: Open-Water Intake and Slant Well Preliminary Design Considerations

Intake Parameters vs. Seawater Supply Capacity	Subregion	Intake Design Considerations by Subregion					Existing Seawater Pump Stations	
		Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	Potential Intake Types	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Open Water[5]	Open Water[5]	Open Water	Open Water
3,000 gpm	Number of Wells[3]	1	1	1	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	30	30	30	30	30	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.34	1.34	1.34	1.34	1.34	N/A	N/A
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	1	1	1	1	1	N/A	N/A
6,000 gpm	Number of Wells[3]	2	2	2	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	42	42	42	42	42	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.37	1.37	1.37	1.37	1.37	N/A	N/A
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	1	1	1	1	1	N/A	N/A
10,000 gpm[7]	Number of Wells[3]	4	4	4	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A

Intake Parameters vs. Seawater Supply Capacity	Subregion	Intake Design Considerations by Subregion					Existing Seawater Pump Stations	
		Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	Potential Intake Types	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Open Water[5]	Open Water[5]	Open Water	Open Water
	Open Water Intake Diameter (in.)[1,6]	60	60	60	60	60	60	60
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	1,100	160
	Flow Velocity (fps)	1.12	1.12	1.12	1.12	1.12	1.21	1.21
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	3/4	3/4
	Number of Screens[8]	1	1	1	1	1	1	1
20,000 gpm	Number of Wells[3]	7	7	7	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	72	72	72	72	72	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.56	1.56	1.56	1.56	1.56	N/A	N/A
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	2	2	2	2	2	N/A	N/A
30,000 gpm	Number of Wells[3]	10	10	10	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	96	96	96	96	96	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.31	1.31	1.31	1.31	1.31	N/A	N/A

Intake Parameters vs. Seawater Supply Capacity		Intake Design Considerations by Subregion					Existing Seawater Pump Stations	
	Subregion	Ocean/Southern Dunes	Ocean/Rocky Area South	Ocean/Rocky Area North	SF Bay/North Bayfront	SF Bay/East Bayfront	SWPS No. 1	SWPS No. 2
	Potential Intake Types	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Slant Well(s)/Open Water	Open Water[5]	Open Water[5]	Open Water	Open Water
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	3	3	3	3	3	N/A	N/A
40,000 gpm	Number of Wells[3]	14	14	14	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	108	108	108	108	108	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.38	1.38	1.38	1.38	1.38	N/A	N/A
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	4	4	4	4	4	N/A	N/A
50,000 gpm	Number of Wells[3]	17	17	17	N/A	N/A	N/A	N/A
	Well Screen Diameter (in.)[4]	18	18	18	N/A	N/A	N/A	N/A
	Well Screen Length (ft.)[9]	700	700	700	N/A	N/A	N/A	N/A
	Open Water Intake Diameter (in.)[1,6]	120	120	120	120	120	N/A	N/A
	Open Water Intake Length (ft.)	2,000	2,000	1,500	200	200	N/A	N/A
	Flow Velocity (fps)	1.40	1.40	1.40	1.40	1.40	N/A	N/A
	Fish Screen Slot Size (in.)[2]	0.04	0.04	0.04	TBD	TBD	N/A	N/A
	Number of Screens[8]	5	5	5	5	5	N/A	N/A

Notes:

1. Assumed to be reinforced concrete pipe (RCP).

2. Slot size for ocean intake screens: 1 mm (0.04 inches). Slot size for screens on bay side to be determined (TBD). Actual size shown for existing SWPS Nos.1 and 2.

3. Estimated production of 3,000 gpm per well; needs to be confirmed by additional analysis.
4. Estimated diameter; needs to be confirmed by additional analysis.
5. Slant wells generally not considered feasible due to silty bottom of SF Bay and regulatory challenges.
6. Actual diameter of intake tunnels for existing SWPS No. 1 and 2 is 60-inch.
7. Actual capacity of existing SWPS No. 1 and 2 is 10,800 gpm (4 pumps @ 2,700 gpm each).
8. Assuming up to 10,000 gpm per tee screen, with maximum through-screen velocity of < 0.5 fps
9. Estimated length, needs to be confirmed by additional analysis.

For an open-water intake supplying a traditional pump station, the size of the intake pipe required will depend on the desired pump station capacity. The preliminary estimated intake tunnel diameters for each of the considered pump station capacities are shown in Table 7-1 for each subregion in which this type of intake is feasible. Diameters range from 60 inches (for 10,000 gpm) to 120 inches (for 50,000 gpm) and are the same size for all subregions for a given capacity. This size of intake pipeline or tunnel will produce a flow velocity under approximately 1.5 fps at peak intake capacity. Table 7-1 also lists other required design criteria for open-water intakes. Most of the missing or unconfirmed data will need to be determined during the next phase of this project following additional evaluation.

It is assumed for this study that open water intakes will be constructed of reinforced concrete pipe for corrosion resistance. Most of an intake conduit could be buried with only the intake head containing the screens exposed above the seafloor, supported on concrete piles drilled into the seafloor. The top elevation of the fish screens should be well below mean high-water level yet their inverts high enough off the seafloor to not get buried by accumulating silt over time. The intake conduit would run nearly horizontal to a gallery or wet well at the pump station, where the seawater would be pumped out of and discharged via a common outlet pipe, or pipes, into the high pressure EFWS network as needed. If a vertical fish screen configuration is employed, a concrete intake structure could be built at the edge of the shoreline with the intake conduit running to the pump station.

7.2.1.2 Rocky Area South Subregion

Depending on the location, either type of intake type or just slant wells are feasible for this subregion. Both open water intake and slant well options are considered feasible for a facility located near Balboa Street and the Great Highway, where direct access to the north end Ocean Beach could be obtained. However, north of this area in the cliff region only open-water intakes may be feasible.

The subsurface geology of the cliffs and bluffs is predominately bedrock, which is not conducive to slant well installation or production. The intake tunnel would need to be bored underneath the beach and cliffs and a submerged intake pipe extended out into the ocean above the seafloor with screens on the end and supported by drilled concrete piles. Alternatively, the tunnel could travel underneath the seafloor then rise above the seafloor at the end via a vertical intake structure. A vertical access shaft would be required for pumps to lift seawater to the ground surface to deliver directly into the existing EFWS network in the area. The pump station on the surface would house the electrical, communications, and security equipment and emergency generator.

7.2.1.3 Rocky Area North Subregion

For a seawater pump station located on Baker Beach within this subregion, both types of intake are considered feasible. Outside of Baker Beach only open-water intakes may be feasible. The installation method and construction challenges for an intake tunnel would be the same as described for the Rocky Area South subregion.

7.2.2 Geologic and Geotechnical Considerations

Geotechnical and seismic induced hazards for facilities located along the Pacific Ocean coastline include liquefaction, landslides, tsunami runup and seismic ground shaking. Factors influencing these hazards include geologic conditions, topography, groundwater levels and distance to active faults.

The underlying geology of San Francisco is characterized by rock of Late Mesozoic or Early Cretaceous age covered by a variably thick sequence of Quaternary alluvial and eolian sediments, as thick as 300 feet. The oceanside locations for the pump station facilities would generally lie either in the beach and sand dune geologic unit along the Southern Dunes and Rocky Area North subregions or Franciscan

Complex sedimentary rocks of the Rocky Area South and portions of the Rocky Area North subregions. The dune deposits cover most of the slopes and hills in western and northern San Francisco. The deposits occur mainly in large sheets, with beach sands mapped along the active Pacific and Golden Gate shorelines. These deposits consist of well sorted fine to medium-grained sand that is wave sorted and subject to shallow saline groundwater. The depth of bedrock is estimated to be greater than 60 feet along the Southern Dunes and Rocky Area North. Franciscan rocks exposed in San Francisco range in age from Late Jurassic through Cretaceous age (165 to 65 million years old).

Historical groundwater depths in the oceanside region vary from 10 to 30 feet in the Southern Dunes and depths of 50 feet in the rocky areas. Given the high groundwater and soft sands, the Southern Dunes area is an area of potential liquefaction. Additionally, these soft materials can amplify seismic ground motions in the event of an earthquake. Based on the topography the rocky areas may be subjected to landslides.

Peak ground acceleration due to a moment magnitude (M) 7.8 on the San Andreas fault is estimated as 0.84 g along the Southern Dunes, 0.72 g along the Rocky Area South and 0.64 g in the Rocky Area North, at the 84^{th} percentile level. Peak ground velocity is estimated as 4.0 to 3.3 fps along the Southern Dunes and 3.3 to 2.6 fps along the rocky areas, at the 84^{th} percentile level (AECOM/AGS, 2013a).

The seismic induced hazards include settlements of the ground surface, lateral deformations, development of excess pore water pressure, buoyancy effects on below groundwater structures, loss of allowable bearing pressure, and increased lateral pressures on utilities and retaining structures extending below the groundwater table. Seismic-induced hazards may be mitigated through a program of ground improvement. Available techniques for soil improvement include vibro-replacement stone columns, deep soil mixing, and grouting techniques. Alternatively, liquefaction-induced settlements can be minimized by supporting structures on deep foundations.

7.2.3 Coastal Hazards and Sea Level Rise Considerations

Any new oceanside intake facilities (such as slant wells and well heads) along the Southern Dunes, Rocky Area South, or Rocky Area North subregions would need to consider potential coastal hazards in their siting and design. Coastal hazards include existing and future inundation and flooding from tides and storm surge, wave runup and overtopping, seasonal and inter-annual beach width fluctuations, wind-blown sand, event-based storm erosion, and long-term shoreline change. Open-water intakes should also consider potential wave and geomorphic hazards (such as sediment burial or scour), depending on their location and depth.

Data sources depicting coastal flood and erosion hazards for existing and future conditions along the Pacific coastline are described in Section 6.4.3. The City and County of San Francisco's Guidance for Incorporating Sea Level Rise into Capital Planning would also apply to seawater intake projects located within the city's Sea Level Rise Vulnerability Zone, as described in Section 6.4.3.

Strategies to address existing and future coastal hazards to oceanside intake facilities would likely include hazard avoidance (*e.g.*, locating well heads beyond the landward limit of potential future coastal hazards) or protection (*e.g.*, locating well heads behind existing or new coastal protection structures such as seawalls). Slant wells buried under the sandy beach should consider event-based, seasonal, inter-annual, and long-term shoreline change to minimize the likelihood of exposure of the pipes due to beach profile changes. Slant wells bored through coastal bluffs or cliffs should consider projected cliff retreat to avoid potential erosion hazards.

7.2.4 Hydrogeology of the Pacific Ocean Coastline

Figure 7-8 depicts a geologic map of the San Francisco area and perimeter shorelines (Graymer *et. al.*, 2006). The various colors on this map illustrate the following Quaternary units: Gray= Artificial Fill (AF), Pink= Landslide and hillslope deposits (Qsl), Yellow = Sand dunes (Qd), Orange = Colma Formation (Qc), Green = older Quaternary Alluvium (Qpa), and Merced Formation = light blue. Franciscan Complex Bedrock is not shown.

Most of the Pacific coastline from Fort Funston on the south to the north end of Ocean Beach is characterized as sand dunes (Qd, shaded yellow) with localized areas of landslide and hillslope deposits (Qsl, shaded pink) near the southern end (north and south of Lake Merced). Much of the coastline north of Ocean Beach to the Golden Gate Bridge is bedrock, with sand dunes near China and Baker Beaches and areas of landslide and hillslope deposits near the cliffs in the Lands End area and south of the bridge. This map also depicts the shoreline of San Francisco Bay circa 1850 (blue line) and extent of historic marshes circa 1898 (blue crosshatch) compared to the current existing shoreline at the edge of reclaimed lands (af, shaded grey).

Figure 7-8: Geologic Map of San Francisco

Figure 7-9 shows the offshore geology of the Pacific coastline in San Francisco (simplified from Greene *et. al.*, 2014, 2015). This map indicates that at Ocean Beach, the area offshore consists of Holocene marine and San Francisco Bay sand deposits, Holocene sand wave deposits, and Holocene inner ebb-tidal delta deposits. All the offshore area within approximately 3,000 feet of the coastline (*i.e.*, the area where slant wells will be installed) consists of Holocene marine and San Francisco Bay sand deposits, which is considered conducive to slant wells. Bathymetry of the offshore of San Francisco shows the sea water depth increases towards the west (ocean) slowly (*i.e.*, seafloor is relatively flat), and the water depth is relatively uniform from north to south in the vicinity of the coastline (within approximately 3,000 feet of the coastline) at Ocean Beach.

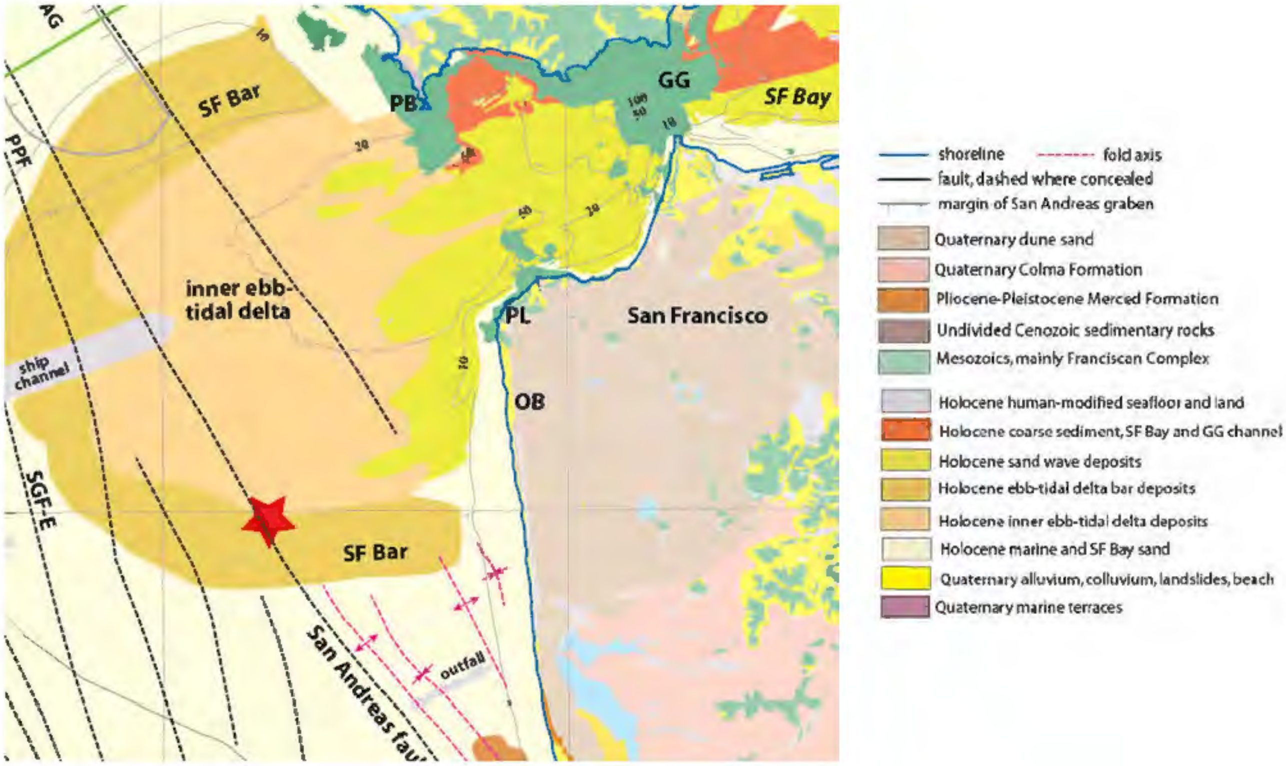


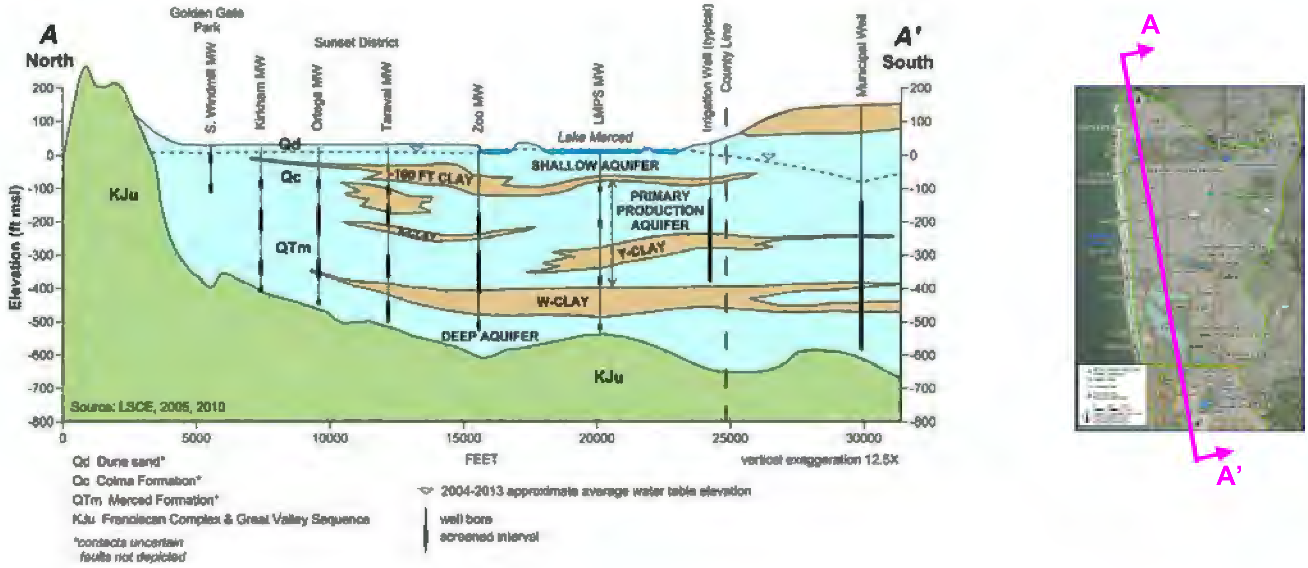
Figure 7-9: Offshore Geologic Map of Pacific Coastline in San Francisco

Ocean Beach is the western edge of the Westside Groundwater Basin as shown in Figure 7-10. This is the largest groundwater basin in San Francisco and is located primarily within the Outer Sunset District, portions of Golden Gate Park, and the Outer Richmond District in San Francisco. The primary water-yielding formations within the Westside Groundwater Basin are the Pliocene to Pleistocene Merced Formation, the Pleistocene Colma Formation, and Quaternary dune sand, which overlay bedrock of the Franciscan Complex. Groundwater development has primarily occurred in the Colma and Merced Formations, although the deeper Merced Formation is the principal water-producing aquifer in the basin. The shallower Colma Formation is also of interest because Lake Merced and Pine Lake are incised within this formation.

Figure 7-11 shows a geologic cross-section of the Pacific coastline from the southern City/County limits to Lands End. Known aquifers and clay layers are shown on this figure, including the shallow aquifer above approximately 100 feet below ground surface (bgs), primary production aquifer between approximately 100 ft to 400 ft bgs, and the deep aquifer below that to bedrock. This figure also shows bedrock rising from approximately 500 to 600 ft bgs to surface exposure in the Lands End area on the left side of the figure. Also shown is the location and depth of several existing municipal wells and irrigation wells installed near this cross-section cut. In general, slant wells will be much shallower than typical vertical groundwater wells.

Source: https://www.westsidewaterresources.org/projects/project1/

Figure 7-10: Westside Groundwater Basin in San Francisco



Source: San Francisco Public Utilities Commission, 2016

Figure 7-11: Geologic Cross Section of North Westside Groundwater Basin

Table 7-2 lists general considerations for slant wells installed along the Pacific coastline. Table 7-3 identifies capacity, design, and construction considerations for slant wells.

Table 7-2: General Considerations for Slant Wells

Item #	Description
1	The most favorable conditions for a subsurface feedwater supply using slant wells are where permeable alluvial deposits extend offshore (typically near the mouths of streams and rivers).
2	Slant wells receive a high percentage of their recharge from ocean water sources including vertical leakage through the seabed and horizontal recharge from offshore aquifers.
3	For slant wells, there is no theoretical limit on the maximum number of wells. The only limitation is on the permeability of the near-shore and offshore aquifers, areal and vertical extent of these deposits.
4	For multiple well arrays, interference between wells and well pods govern the number and spacing of wells, while geologic conditions and coastline land availability governs the limitation on spatial and vertical extent of the well fields
5	Regarding permits, slant wells typically have a more favorable view by regulatory agencies and environmental community, making them easier to permit than other intake systems.
6	Percentage of recharge from inland and ocean water sources, as well as potential impacts, are typically determined using site-specific calibrated groundwater models (flow and transport models).
7	Proven well design methods developed for vertical water supply wells may be applied to slant wells; and proven well construction technology embraces the principle of “simple and strong.”
8	Well casing and screen need to be strong and made of corrosion resistant materials capable of withstanding the initial construction as well as multiple rehabilitations in a seawater environment.
9	Well logging of slant wells requires special tools and methods for successful logging.
10	Slant well layouts include multiple wells from one central wellhead area.
11	Coastal erosion and sea level rise are factors affecting the siting of slant well layouts.
12	Slant well angles and lengths can be varied to minimize salinity variations and as required for site-specific aquifers.

Item #	Description
13	The cone of depression in the vicinity of slant wells is oval shaped with the highest drawdown occurring in the center of the vertical projection of the well screen.
14	Sustainability of a slant well supply includes periodic rehabilitation with an expected frequency ranging between three to five years, or more, depending on site conditions and operation.
15	Experience with Monterey Peninsula Water Supply Project has shown that telescoping can extend 250 to 320 ft before a reduction in diameter is required.
16	Slant wells can be pumped at high capacities using submersible pumps placed on an angle and centered within the pump house chamber.

Table 7-3: Capacity-Design-Construction Considerations for Slant Wells

Subject Area	Item #	Description
Slant Well Capacity, Design, and Construction	1	Does the near-shore and subsea materials consist of sand and gravel? Or is the aquifer highly permeable underneath the seafloor?
	2	Does the high permeable aquifer have sufficient thickness (*e.g.*, high transmissivity), and are in hydraulic continuity with the ocean? Are there confining layers (clay layers) inhibiting either horizontal or vertical recharge to the well?
	3	If the subsea materials consist of consolidated rocks (*e.g.*, sandstone, limestone, granite, or other rock), do these rocks contain sufficient secondary porosity features (joints and fissures) in hydraulic continuity with the seafloor? - Production and filtration are generally not as efficient as alluvial systems except for karstic limestones.
	4	Slant well capacity is a function of the aquifer parameters (*e.g.*, horizontal and vertical hydraulic conductivity, storability, leakance, *etc.*), as well as the screened interval of the well and angle below horizontal. Especially critical is the amount of vertical leakage through the benthic zone of the sea floor.
	5	Well capacity can be evaluated by long term pumping test. Well capacity can be extrapolated from the specific capacity diagram developed from the Test Slant Well step drawdown test and modified for additional well screen length.
	6	Proper slant well design should maximize aquifer production, stabilize fine-grained materials, and maintain as large a screen slot opening as possible. The single most important design objective is prevention of fine-grained materials (sand and silt) from entering the well.
	7	Well capacity can be evaluated by numerical groundwater model (MODFLOW model) if the seafloor aquifer is well characterized.

Subject Area	Item #	Description
Wellhead Location (permitting, access, environmental and operational factors)	1	Slant wells should be located as close to the ocean as possible (to maximize recharge from ocean sources and minimize impacts to inland resources). This maximizes both vertical leakage through the seabed and horizontal recharge from offshore aquifers.
	2	Other factors include coastal erosion, 100-year flood event, sea level rise, and proximity to sensitive habitat, well construction footprints and access to the well drilling site and equipment staging area
	3	Access and Maintenance: Periodic access to the wellhead area for regular measurements within the well and routine well redevelopment
	4	Wellhead Depth Below Land Surface: Typically, slant well wellheads are buried 3-5 ft below ground surface to minimize any nuisance and still allow access to the site
	5	Environmental Concerns: a). Adverse impacts to the natural environment (*e.g.*, sensitive ecological or environmental areas) during construction and operation; b). Slant wellfield production and its pumping (resulting cone of depression) may result in lowering of water levels in upgradient area (east of great highway), thus potentially affecting the vegetation and native riparian species sensitive to water level decreasing; and c). Pumping-induced drawdown causes higher gradient towards ocean and higher groundwater migration towards the ocean (potentially causing faster COC migrations towards the sea if there are any COC plumes near the coast).
	6	Geotechnical Issues: Beach facilities geotechnical conditions, potential geologic and seismic hazards, including seismic shaking, liquefaction, and beach erosion.
	7	Operational Concerns (Project Impacts): Impacts may occur from interference with onshore groundwater pumping levels (lower the pumping rates of inland wells) and effects on nearby water body.
	8	Changes in Freshwater/Saltwater Interface: Where seawater intrusion exists, slant well pumping from offshore aquifers can constitute a seawater intrusion control measure due to the interception of seawater and stabilization of the interface which otherwise would move inland, contributing to seawater intrusion
	9	Other Factors: Other important factors include coastal erosion, the landward extent of a 100-year flood event, and sea-level rise (risk of sea level changes during a 50-year life cycle) in designing an adequate set-back distance from the ocean.

7.2.5 Operations and Maintenance

Operation and maintenance practices for open-water intake structures or slant wells constructed in the Pacific Ocean region should include the following items at a minimum:

- Submersible pumps and motors in slant wells should be exercised regularly (*e.g.*, monthly) to ensure their proper operation.
- Permanently submerged fish screens for open water intakes should be regularly inspected, cleaned, and maintained using a diver.
- The dry land area over slant wells should be kept free from potential sources of contamination that could possibly infiltrate into the aquifer and contaminate the groundwater.
- Interior of well screens for slant wells should be regularly inspected (*e.g.*, annually) via underwater video camera.
- Slant well array wellhead enclosure sites should be well maintained and kept free from accumulated trash, debris, weeds, graffiti, blown sand, *etc.* Unencumbered access should

always be maintained (*e.g.*, entrance gates not blocked by parked vehicles, *etc.*). Enclosure interiors should also be maintained in a clean, uncluttered, and safe condition.

- Security systems should be checked and tested regularly to ensure proper operation.
- All metallic components (visible piping and valves, electrical cabinets, *etc.*) should be regularly inspected for corrosion and repaired as necessary. Protective coatings should be maintained in excellent condition.
- Emergency generators should be operated periodically (*e.g.*, monthly) to ensure their proper operation. Fuel should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.

7.3 San Francisco Bay Region

This section provides a discussion of the preliminary engineering design considerations and other select topics for intakes to support future seawater supply facilities located along the San Francisco Bay shoreline in San Francisco. This includes both the North Bayfront and East Bayfront subregions as shown in Figure 5-1.

7.3.1 Engineering Considerations

7.3.1.1 North and East Bayfront Subregions

Only open-water intakes are considered feasible to support new seawater pump stations installed along the bay in either subregion. As mentioned in Section 7.1.1, for an open-water intake, the size of the intake conduit required is dependent upon the desired pump station capacity. The preliminary estimated intake conduit diameters for each of the considered pump station capacities are shown in Table 7-1 for these two subregions. Diameters range from 60 inches (for 10,000 gpm) to 120 inches (for 50,000 gpm) and are the same size in all subregions for a given capacity. This size of tunnel will produce a flow velocity under approximately 1.5 fps at peak intake capacity. Table 7-1 also lists other required design criteria for open-water intakes. Most of the unknown or unconfirmed data will need to be determined during the next phase of this project following additional evaluation.

7.3.2 Geologic and Geotechnical Considerations

Geotechnical and seismic induced hazards for facilities located along the bay include liquefaction, landslides, tsunami runup and seismic ground shaking. Factors influencing these hazards include geologic conditions, topography, groundwater levels and distance to active faults.

The underlying geology of San Francisco is characterized by rock of Late Mesozoic or Early Cretaceous age covered by a variably thick sequence of Quaternary alluvial and eolian sediments, as thick as 300 feet. The bayside locations for the pump station facilities lie in regions with beach and dune sand geologic units or bay muds and artificial fill. Younger Bay Muds are around the shore of the San Francisco Bay and mostly covered by artificial fill. The thickness of the Younger Bay Mud is variable from 10 to 70 feet around the San Francisco Bay. The Younger Bay Mud is soft or very soft, organic-rich clay to silty clay; and often containing numerous clam shells. Most of the artificial fill was non-engineered. The fill was often placed directly over Bay Mud with a consistency and density that is highly variable. The depth of bedrock is estimated to be greater than 60 feet along most of the bayside.

Historical groundwater depths are 5 to 10 feet in the North and East Bayfront subregions. Given the high groundwater, younger Bay muds and artificial fill, the North and East Bayfronts are areas of potential liquefaction. Additionally, these soft materials can amplify seismic ground motions in the event of an earthquake.

Peak ground acceleration due to a moment magnitude (M) 7.8 on the San Andreas fault is estimated as 0.60 to 0.45 g along the North and East Bayfronts, at the 84^{th} percentile level. Peak ground velocity is estimated as 2.6 to 1.5 fps along the North and East Bayfronts, at the 84^{th} percentile level (AECOM/AGS, 2013a).

The seismic induced hazards include settlements of the ground surface, lateral deformations, development of excess pore water pressure, buoyancy effects on below groundwater structures, loss of allowable bearing pressure, and increased lateral pressures on utilities and retaining structures extending below the groundwater table. Seismic-induced hazards may be mitigated through a program of ground improvement. Available techniques for soil improvement include vibro-replacement stone columns, deep soil mixing, and grouting techniques. Alternatively, liquefaction-induced settlements can be minimized by supporting structures on deep foundations.

7.3.3 Coastal Hazards and Sea Level Rise Considerations

Any new bayside intake facilities (such as open-water intakes and supporting landside infrastructure) along the North and East Bayfront subregions would need to consider potential coastal hazards in their siting and design. Coastal hazards include existing and future inundation and flooding from tides and storm surge and wave runup and overtopping. Shoreline erosion is less of a concern along the bay shoreline than the Pacific coastline since most of San Francisco's bay shoreline is armored; however, any supporting landside facilities located along unarmored portions of the shoreline should consider the potential for erosion. Like open water intakes within the Pacific Ocean region, open water intakes within the Bay region should also consider potential wave and geomorphic hazards (such as sediment burial or scour), depending on their location and depth.

Data sources depicting coastal flood hazards for existing and future conditions along the bay shoreline are described in Section 6.3.3. The City and County of San Francisco's Guidance for Incorporating Sea Level Rise into Capital Planning would also apply to seawater intake projects located within the city's Sea Level Rise Vulnerability Zone, as described in Section 6.2.3.

Strategies to address existing and future coastal hazards to bayside intake facilities would likely include hazard avoidance (*e.g.*, locating facilities beyond the landward limit of potential future inundation and flooding) or protection (*e.g.*, locating facilities behind existing or new coastal protection structures such as seawalls). Site modifications to landside facilities such as raising site elevations, elevating critical electrical and mechanical equipment above projected future flood elevations, or floodproofing buildings or equipment enclosures would also mitigate future flood risks.

7.3.4 Operations and Maintenance

Operation and maintenance practices for open-water intake structures constructed in the San Francisco Bay region are the same as the Pacific Ocean region and should include the following items at a minimum:

- Submersible pumps and motors in slant wells should be exercised regularly (*e.g.*, monthly) to ensure their proper operation.
- Permanently submerged fish screens should be regularly inspected, cleaned, and maintained using a diver.
- Security systems should be checked and tested regularly to ensure proper operation.
- All metallic components (visible piping and valves, electrical cabinets, *etc.*) should be regularly inspected for corrosion and repaired as necessary. Protective coatings should be maintained in excellent condition.

- Emergency generators should be operated periodically (*e.g.*, monthly) to ensure their proper operation. Fuel should be used or replaced at regular intervals to ensure it remains fresh. Fuel tanks should always be topped off and left full after each use.

Chapter 8: Integration with Other City Initiatives

This chapter provides an overview of the need for consideration of other development and redevelopment plans within the city, and how expansion of the EFWS could impact (positively or negatively) other infrastructure initiatives.

The City of San Francisco is ever changing in terms of population, business, and industries. The infrastructure to support the city and region is continually expanded, upgraded, and adapted to meet ever-changing needs. There are numerous development and redevelopment initiatives in progress or planned throughout the city; it is important to consider this context when evaluating options for additional seawater supplies for the EFWS.

Similarly, it is important to consider environmental, social, and governance (ESG) issues underway within the City. Social, economic, racial, gender, and other equity concerns are a factor in San Francisco decision-making, and may impact development of new seawater pump stations.

Examples of planned development and redevelopment on the Bay side and ocean side of the city are shown in Figure 8-1 and Figure 8-2.

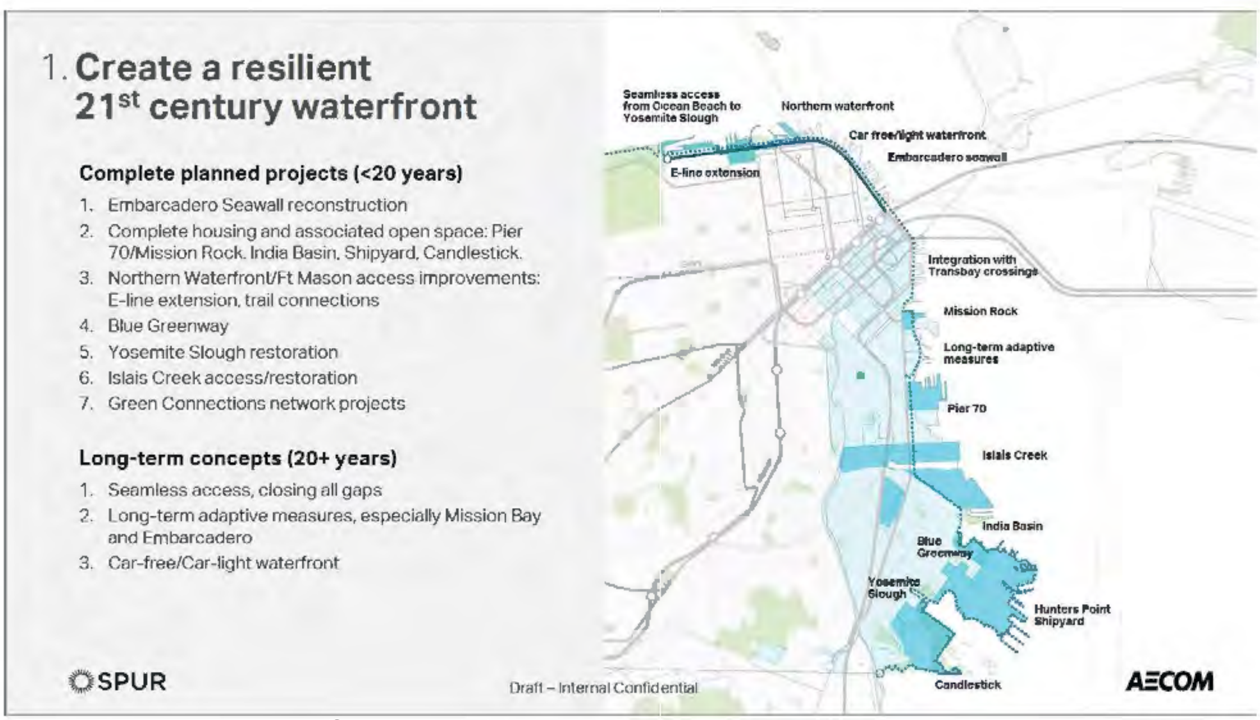


Figure 8-1: Potential Bay-Side Redevelopment

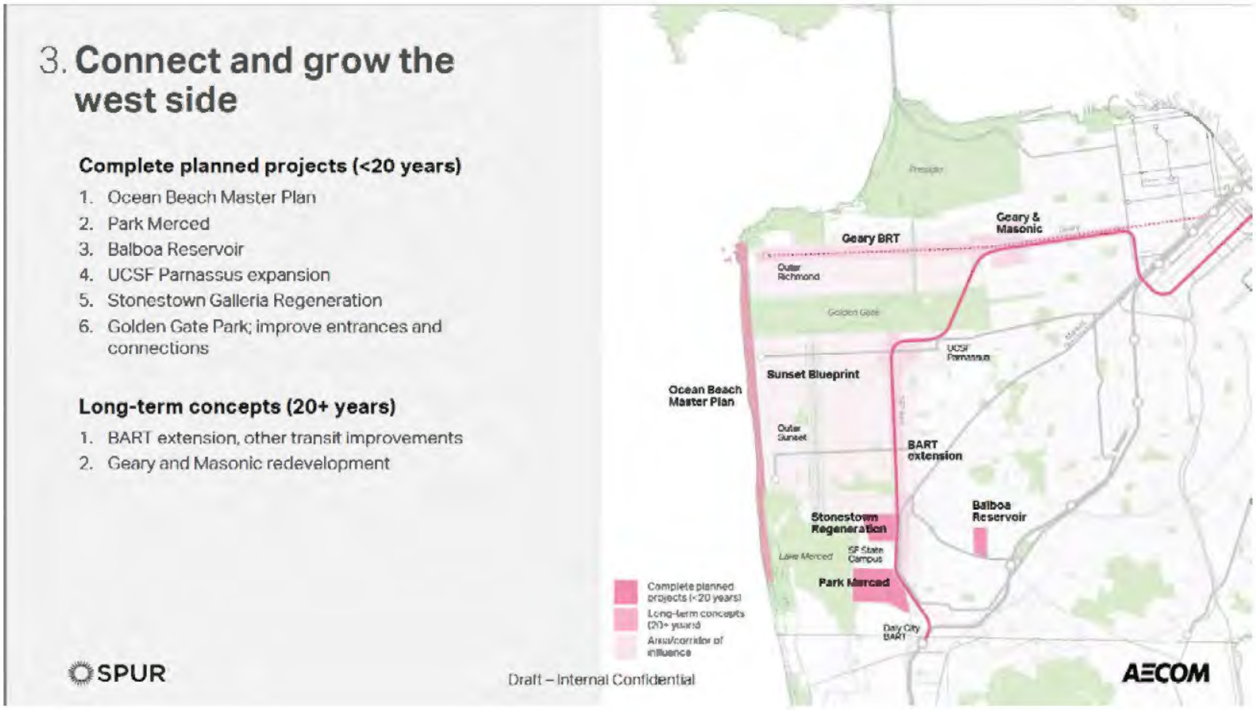


Figure 8-2: Potential Ocean-Side Redevelopment

Addition of new seawater supplies for the EFWS will need to be coordinated with these development and redevelopment efforts. Opportunities exist for creation of co-benefits, such as integrating new EFWS components into the urban landscape with the inclusion of amenities, as has been done in other urban settings.

An example of such co-benefits is the False Creek Pump Station at David Lam Park in Vancouver, BC, shown in Figure 8-3. The pump station is an integral part of this downtown waterfront park. During monthly testing of the pump station systems, water displays occur on the first Friday of each month.


Figure 8-3: False Creek Pump Station at David Lam Park, Vancouver BC

Chapter 9: Costs

This chapter provides a summary of the initial and lifecycle costs of addition of new seawater intake sources for the EFWS. Details of the cost estimates are included in Appendix E.

9.1 Initial Design & Construction

Estimated initial costs at this pre-feasibility study level for the different subregions and flow rates are summarized in Table 9-1. These values include design, permitting, and related up-front costs from the intake location to the closest tie-in to the existing EFWS, but do not include costs associated with increasing piping sizes of the existing EFWS to accommodate additional flows.

Table 9-1: Estimated Initial Costs

	Ocean Side							Bay Side	
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water
3,000 gpm	41	68	39	67	70	39	62	24	25
6,000 gpm	51	76	50	75	79	48	68	25	26
10,000 gpm	78	100	79	101	122	69	87	43	44
20,000 gpm	99	123	104	128	174	97	115	57	58
30,000 gpm	120	155	124	159	239	116	144	74	74
40,000 gpm	146	189	149	192	314	141	175	92	93
50,000 gpm	169	224	174	229	404	164	209	112	113
Color scheme for each flow:		Lowest Initial Cost		Highest Initial Cost			(Million $, 2020 basis)		

The costs summarized in Table 9-1 are allocated among costs for environmental / permitting / land acquisition; costs for the pump station itself; and costs for the piping to connect to the EFWS, as shown in Table 9-2.

Table 9-2: Estimated Initial Costs by Cost Category

		Ocean Side							Bay Side	
Flow	Component	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront
		Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water
3,000 gpm	Environmental / Permitting / Land Acq.	8.0	8.9	8.0	8.9	8.9	8.0	8.9	8.9	8.9
	Pump Station	7.7	34.3	7.7	34.3	33.3	7.2	28.8	14.2	14.2
	Piping	25.0	25.0	23.3	23.3	28.0	23.8	23.8	0.9	1.8
	TOTAL (rounded up)	**41**	**68**	**39**	**67**	**70**	**39**	**62**	**24**	**25**
6,000 gpm	Environmental / Permitting / Land Acq.	8.2	9.2	8.2	9.2	9.2	8.2	9.2	9.2	9.2
	Pump Station	11.2	35.1	11.2	35.1	34.1	10.7	29.6	15.0	15.0
	Piping	31.2	31.2	31.0	31.0	35.5	29.2	29.2	1.0	1.8
	TOTAL (rounded up)	**51**	**76**	**50**	**75**	**79**	**48**	**68**	**25**	**26**
10,000 gpm	Environmental / Permitting / Land Acq.	10.4	12.1	10.4	12.1	12.1	10.4	12.1	13.8	13.8
	Pump Station	29.7	50.1	29.7	50.1	69.0	29.2	44.6	28.2	28.2
	Piping	37.5	37.5	38.7	38.7	41.0	29.8	29.8	1.1	2.0
	TOTAL (rounded up)	**78**	**100**	**79**	**101**	**122**	**69**	**87**	**43**	**44**
20,000 gpm	Environmental / Permitting / Land Acq.	11.9	13.6	11.9	13.6	13.6	11.9	13.6	16.0	16.0
	Pump Station	45.9	68.0	45.9	68.0	111.2	45.4	61.5	40.1	40.1
	Piping	41.6	41.6	46.5	46.5	49.5	39.5	39.5	1.2	2.2
	TOTAL (rounded up)	**99**	**123**	**104**	**128**	**174**	**97**	**115**	**57**	**58**
30,000 gpm	Environmental / Permitting / Land Acq.	13.4	15.1	13.4	15.1	15.1	13.4	15.1	18.1	18.1
	Pump Station	58.7	92.4	58.7	92.4	168.0	58.2	83.9	54.1	54.1
	Piping	47.9	47.9	51.6	51.6	55.5	44.8	44.8	1.3	2.2
	TOTAL (rounded up)	**120**	**155**	**124**	**159**	**239**	**116**	**144**	**74**	**74**
40,000 gpm	Environmental / Permitting / Land Acq.	14.9	16.8	14.9	16.8	16.8	14.9	16.8	20.7	20.7
	Pump Station	74.9	115.4	74.9	115.4	233.2	74.4	105.9	69.6	69.6
	Piping	56.2	56.2	59.4	59.4	64.0	51.8	51.8	1.4	2.3
	TOTAL (rounded up)	**146**	**189**	**149**	**192**	**314**	**141**	**175**	**92**	**93**
50,000 gpm	Environmental / Permitting / Land Acq.	16.3	18.8	16.3	18.8	18.8	16.3	18.8	23.6	23.6
	Pump Station	87.7	140.8	87.7	140.8	309.9	87.2	130.3	86.6	86.6
	Piping	64.5	64.5	69.7	69.7	74.8	60.2	60.2	1.6	2.5
	TOTAL (rounded up)	**169**	**224**	**174**	**229**	**404**	**164**	**209**	**112**	**113**
	Color scheme for each flow:	Lowest Initial Cost		Highest Initial Cost			(Million $, 2020 basis)			

9.2 Lifecycle Cost

Lifecycle costs for the seawater intakes in the different subregions are shown in Table 9-3 below. These costs are based on a 45-year lifecycle and 4% interest rate, assuming shorter-lived components (*i.e.* the slant well intakes and pumps or the open water intake screens) will be replaced at the 15th and 30th years, and account for periodic operations and maintenance.

Periodic operations and maintenance costs considered include estimated diesel fuel (pump station) or electric power (slant wells) costs, assume monthly testing, and for one major multiple alarm fire per year with the pump station or slant wells in operation.

Table 9-3: Estimated Lifecycle Costs (Net Present Value)

	Ocean Side							Bay Side	
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water
3,000 gpm	56	80	54	78	82	54	73	35	36
6,000 gpm	73	87	72	87	90	70	79	37	37
10,000 gpm	131	111	132	112	134	123	98	55	55
20,000 gpm	184	137	189	142	188	181	128	71	72
30,000 gpm	229	172	232	176	255	225	160	90	91
40,000 gpm	286	212	289	215	338	281	198	115	116
50,000 gpm	334	251	339	256	430	329	236	139	140
	*assuming 45 year term and 4% interest rate								
Color scheme for each flow:	Lowest NPV		HighestNPV			(Million $, 2020 basis)			

Chapter 10: Project Development / Next Steps

This chapter provides a high-level summary of tasks and activities required to advance the EFWS Seawater Supply from this initial study towards a full feasibility study and (potentially) to design and implementation.

Advancing the concept of additional seawater intake supplies to the City's EFWS will require further engineering and analysis, including assessment of flow requirements, refinement of engineering aspects, and environmental / permitting requirements.

10.1 Flow Requirements

The information contained in this study has assumed a range of potential flow rates for new seawater supply sources for the EFWS (ranging from 3,000 gpm to 50,000 gpm) in five geographically dispersed areas around the waterfront of the City. Further definition of the required firefighting demands (both in terms of quantity and location(s) of supplemental flow) is needed to advance to the next stage of planning and analysis.

SFPUC is currently conducting a long-range planning study for the EFWS, taking into consideration currently planned and potential future modifications to the overall EFWS system. That study will provide further definition of the required supplemental flows, both in terms of quantity and geographic region where flows are required.

10.2 Engineering

Advancing the concepts presented in this report to the next stage of development will require additional engineering analyses and investigations, including Feasibility Studies, Conceptual Engineering Reports, and Alternatives Analysis Reports.

Some of the anticipated future investigations as part of this process include:

- Hydraulic Modeling: Modeling of the existing and potential enhancements to the EFWS, to determine appropriate sizes of seawater intake/pumping facilities and distribution piping to connect to the existing EFWS
- Geotechnical Engineering: Investigation of offshore sediment characteristics and permeability, to provide key information for design of slant wells or foundations for open water intakes
- Structural Engineering: Assessment of static, live, and seismic loadings (based on site-specific locations) for intake and pumping facilities, as well as transmission lines to connect to the existing EFWS
- Civil Engineering: Assessments related to site selection, grading, pipeline routing, and utility conflicts
- Mechanical Engineering: Selection of specific pumping equipment and appurtenances, based on flow capacities and required discharge pressures for specific seawater pump station locations and EFWS tie-in point
- Electrical / Power Engineering: Assessment of required sizes of diesel or electric prime movers (and relevant backup energy sources), based upon seawater supply flow rates and required discharge pressures

- Supporting Engineering Disciplines:
  - Topographic surveys of potential intake/pump station sites and pipeline alignments to connect with the existing EFWS
  - Bathymetric surveys of coastal areas for potential intake locations
  - Coastal engineering analyses of currents and potential for sediment deposition
  - Detailed cost estimates and construction schedules of concepts selected

10.3 Environmental / Permitting

Understanding and early coordination of environmental compliance and permit acquisition efforts will result in a more efficient project planning and public outreach efforts.

Environmental compliance includes the preparation of NEPA and CEQA documentation so that affected NEPA lead federal agencies and the City of San Francisco (as a lead CEQA agency) can document their decision-making process under the federal and state policies.

It will be important to identify the relevant NEPA lead agency early once a preferred course of action has been identified.

Concurrent and subsequent efforts associated with permit acquisition and various encroachment and lease approvals from public agencies would also be required.

10.4 Implementation Timeline

The timeline to advance the concept of adding new seawater supply sources to the EFWS is largely dependent on identification of preferred alternative(s) for development. A general timeline is as follows:

- Planning: Determining flow requirements; conducting feasibility studies, alternatives analyses, and selecting a preferred alternative may take 12- 24 months.
- Environmental Review & Permitting: Depending on the preferred course of action, NEPA and CEQA efforts may take 18 to 24 months, and subsequent permitting would take up to 24 months.
- Design: Depending on the preferred course of action (*e.g.* location(s) & size(s) of seawater intakes), engineering design activities may take 12 – 36 months.
- Construction & Commissioning: Depending on the preferred course of action (*e.g.* location(s) & size(s) of seawater intakes), construction and commissioning activities may take 24 – 48 months.

The total project timeline is anticipated to range from 90 – 156 months (7.5 – 15 years).

Chapter 11: References

AECOM, 2016. Sea Level Rise Pilot Study, Future Conditions Analysis and Mapping, San Francisco County, CA. California Coastal Analysis and Mapping Project Open Pacific Coast Study. Prepared for FEMA Region IX. January 2016.

AECOM, 2019. Potable Emergency Firefighting Water System Sunset Pump Station Summary TM, September 25, 2019

AECOM, 2020(a). Emergency Firefighting Water System Supply Analysis Technical Memorandum. Prepared for San Francisco Public Utilities Commission. March 12.

AECOM, 2020(b). Potable Emergency Firefighting Water System Pipeline Alternatives Analysis Report, July 1, 2020.

AECOM, 2020(c). Potable Emergency Firefighting Water System Pipeline Conceptual Engineering Report, July 1, 2020.

AECOM, 2021.Emergency Firefighting Water System Future Planning Study, (in preparation).

AECOM / AGS, 2013(a). CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS), Task 4 – Geologic, Seismologic, and Geotechnical Hazards, January 23, 2013.

AECOM / AGS, 2013(b). CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS), Task 7 – Seawater Intake Tunnels Technical Memorandum, January 2013.

AECOM / AGS, 2013(c). CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS), Technical Memorandum - Task 13.4 – Pump Station No. 2 Alternatives, July 2013.

Barnard, P.L., Hanes, D.M, Rubin, D.M, and Kvitek, R.G. (2006). Giant sand waves at the mouth of San Francisco Bay. *EOS, Transactions American Geophysical Union,* 87(29, 285-289.

Barnard, P.L., Erikson, L.H., Foxgrover, A.C., Limber, P.L., O'Neill, A.C., and Vitousek, S., 2018, Coastal Storm Modeling System (CoSMoS) for Central California, v3.1 (ver. 1f, May 2020): U.S. Geological Survey Data Release, https://doi.org/10.5066/P9NUO62B.

City and County of San Francisco 2018-2019 Civil Grand Jury, 2019. Act Now Before It is Too Late: Aggressively Expand and Enhance our High-Pressure Emergency Firefighting Water System.

Graymer, R.W., Moring, B.C., Saucedo, G.J., Wentworth, C.M., Brabb, E.E., and Knudsen, K.L., 2006, Geologic map of the San Francisco Bay region: U.S. Geological Survey Scientific Investigations Map, SIM-2918, 1 sheet, scale 1:275,000.

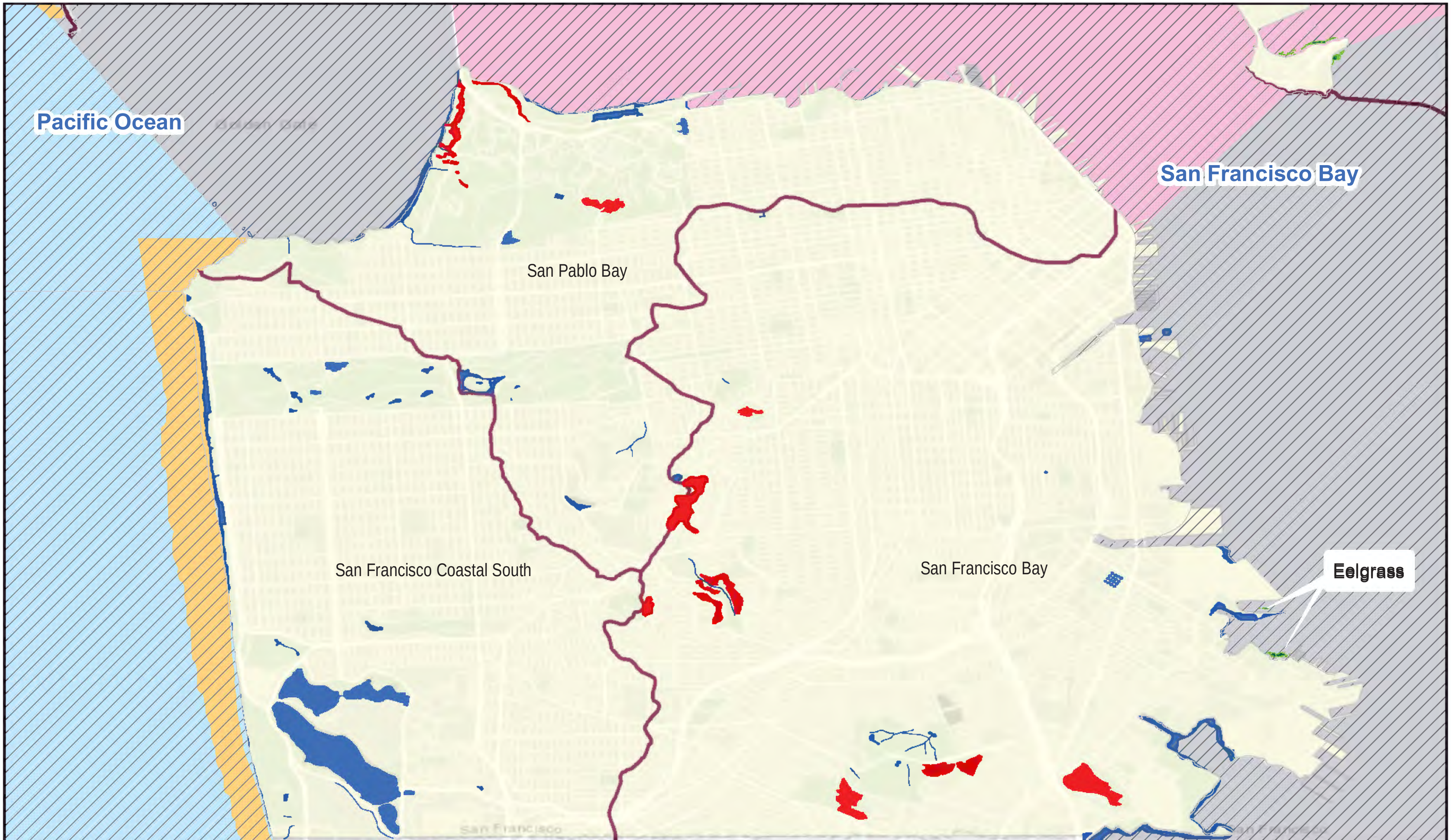
Greene, H.G., Hartwell, S.R., Manson, M.W., Johnson, S.Y., Dieter, B.E., Phillips, E.L., and Watt, J.T., 2014, Offshore and onshore geology and geomorphology, Offshore of Pacifica map area, California, sheet 10, in Cochran, S.A. and Edwards, B.D., eds., California State Waters Map Series—Offshore of Pacifica, California: U.S. Geological Survey Open-File Report 2014-1260, pamphlet 38 p., 10 sheets, scale 1:24,000, http://dx.doi.org/10.3133/ofr20141260. IP-052391.

Greene, H.G., Johnson, S.Y., Manson, M.W., Hartwell, S.R., Endris, C.A., and Bruns, T.R., 2015, Offshore and onshore geology and geomorphology, Offshore of San Francisco map area, California, sheet 10, in Cochrane. G.R. and Cochran, S.A., eds., California State Waters Map Series—Offshore of

San Francisco, California: U.S. Geological Survey Open-File Report 2015-1068, pamphlet 39 p., 10 sheets, scale 1:24,000, http://dx.doi.org/10.3133/ofr20151068. IP-052334.

San Francisco Public Utilities Commission, 2016, North Westside Basin Groundwater Sustainability Plan, draft: February 2016.

Appendix A: Planning and Resource Area Maps



Natural Resources

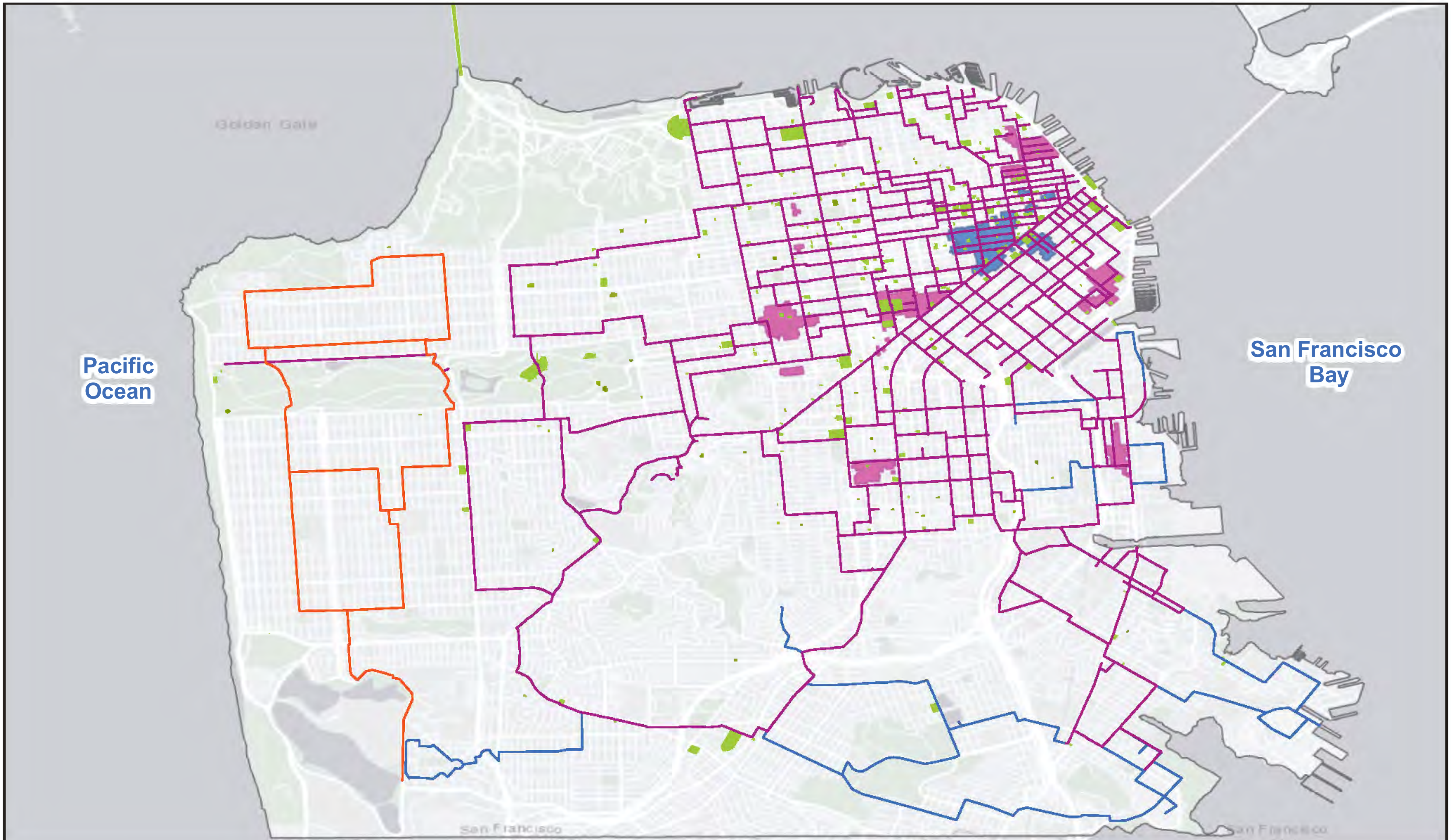
- City of San Francisco Boundary
- Eelgrass
- Watershed
- Jurisdictional Wetland

ESA Critical Habitat Designations (Additional fine-scale species data should be reviewed for CEQA & NEPA purposes once alternative sites are identified)

- Arctostaphylos Franciscana
- Green Sturgeon
- Black Abalone
- Salmon, Chinook
- Leatherback Sea Turtle

0 0.5 1 Miles

Data Sources:
City of San Francisco: https://data.sfgov.org/Geographic-Locations-and-Boundaries/SF-Shoreline-and-Islands/rgcx-5tix
Eelgrass: https://www.sfei.org/data/eelgrass-survey-gis-data#sthash.rL44t8Iz.dpbs
Watersheds and Wetlands: https://www.fws.gov/wetlands/data/Mapper.html
ESA Critical Habitat Designations: https://www.fisheries.noaa.gov/resources/maps?title=critical+habitat&field_management_area_value%5BWest+Coast%5D=West+Coast&field_species_vocab_target_id=&sort_by=created



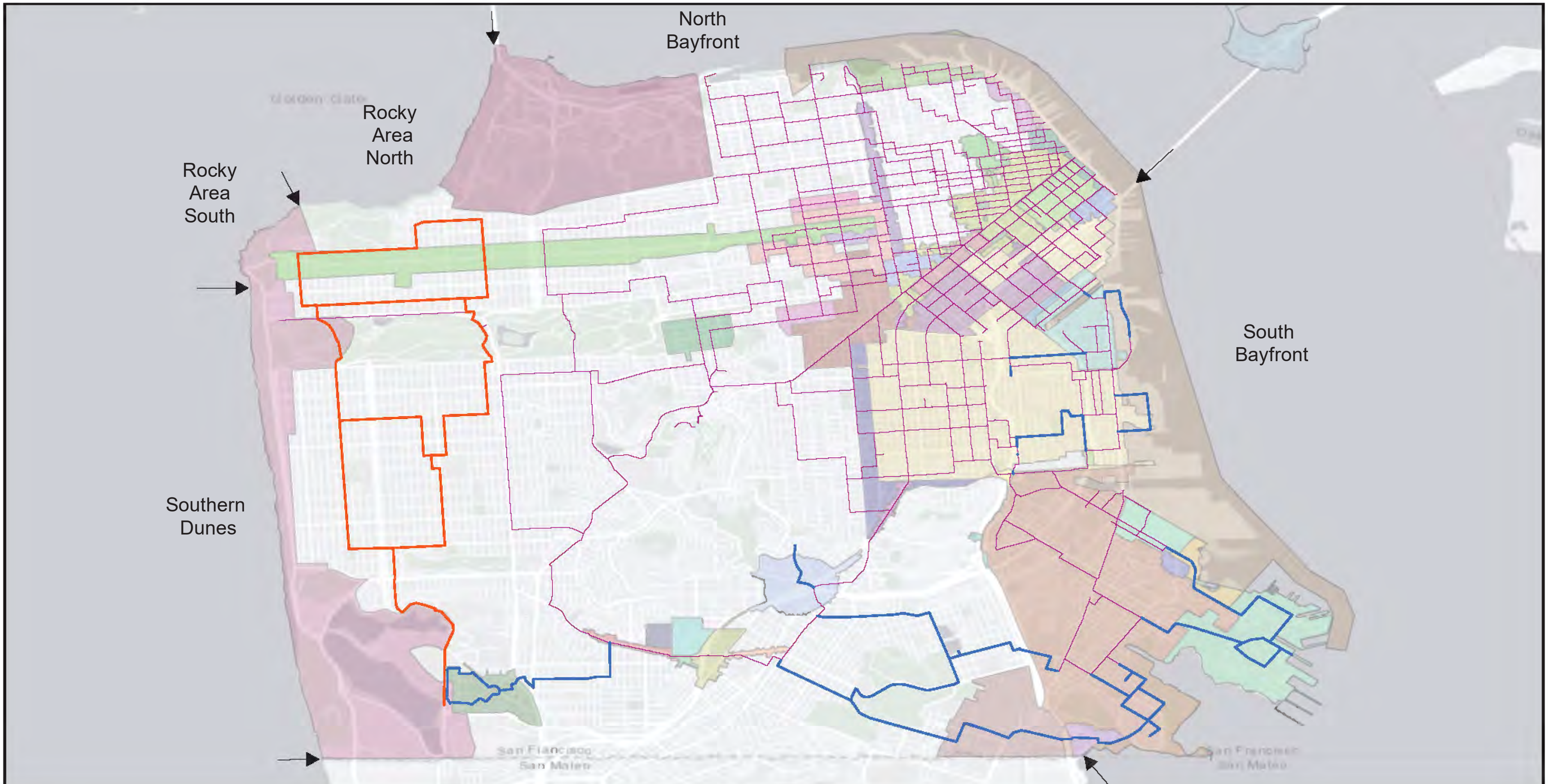
Historic Resources

PEFWS Pipes
Existing EFWS Pipes
Planned EFWS Pipes
Historic Landmarks
Landmark Districts
Conservation Districts
City of San Francisco Boundary

0 0.5 1 Miles

Data Sources:
City of San Francisco: https://data.sfgov.org/Geographic-Locations-and-Boundaries/SF-Shoreline-and-Islands/rgcx-5tix
Conservation Districts: https://data.sfgov.org/Geographic-Locations-and-Boundaries/Conservation-Districts-as-listed-in-Article-11-of-/4exc-em5v
Landmark Districts: https://data.sfgov.org/Geographic-Locations-and-Boundaries/Landmark-Districts/vnrd-fpg7
Historic Landmarks: https://data.sfgov.org/dataset/Landmarks/hfwn-m3tm

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



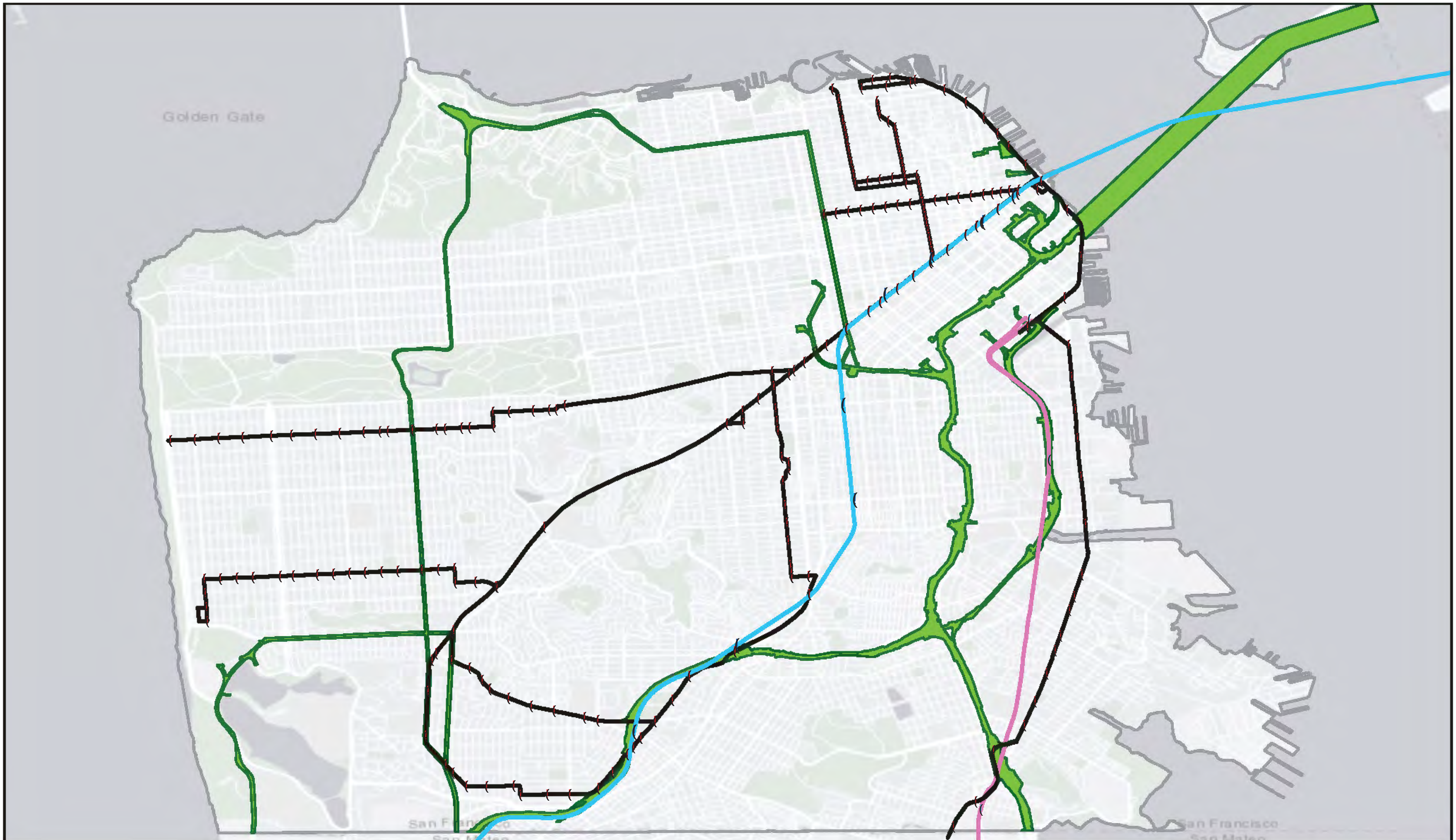
Representation of City of San Francisco Planning Areas

- A-1
- A-2
- BP: City College
- BP: Ocean Avenue Commercial District
- BP: Reservoir
- BP: Transit Station
- Balboa Park
- Base of Telegraph Hill Subarea
- Bayshore Boulevard
- Bayview Hunters Point
- Candlestick Point
- Central SoMa
- Central Waterfront (EN)
- Cesar Chavez East Caltrans EJ Grant
- Chinatown
- Civic Center
- Civic Center Public Realm Plan
- Dogpatch Public Realm Plan
- Downtown
- Downtown Streetscape Plan
- East SoMa (EN)
- Eastern Neighborhoods (Complete)
- Eastern Neighborhoods w/Valencia
- Executive Park
- Ferry Building Subarea
- Fisherman?s Wharf Public Realm Plan
- Geary Corridor
- Glen Park
- Glen Park (superseded)
- Haight Ashbury Public Realm Plan
- Hunters Point Shipyard
- Hunters View
- India Basin
- India Basin Industrial Park
- India Basin Shoreline/Area C
- Japantown
- Lower Haight Public Realm Plan
- Market and Octavia
- Market and Octavia Living Alleys
- Mid-Market
- Mission (EN)
- Mission Bay
- Mission District Streetscape Plan
- Mission Public Life Plan
- Northeast Embarcadero Study
- Northeast Waterfront
- Ocean and Geneva Corridor Design Plan
- Parkmerced
- Pier 70
- Port
- Presidio
- Railyard
- Rincon Hill
- Rincon Hill Streetscape Plan
- Schlage Lock
- Sea Wall Lot 337
- Showplace Square Open Space Plan
- Showplace Square/Potrero Hill (EN)
- South Beach Subarea
- South of Market
- The Market Street Hub Project
- Transbay
- Transbay Zone 1
- Transit Center District
- Transit Center District Streetscape Plan
- Treasure Island
- Van Ness Corridor
- Visitacion Valley
- Western Shoreline
- Western SoMa (EN)
- Yerba Buena
- Planned EFWS Pipes
- PEFWS Pipes
- Existing EFWS Pipes
- Shoreline Subregion Boundary

0 0.5 1 Miles

Data Source for Planning Areas: https://data.sfgov.org/City-Infrastructure/Planning-Areas/bkzf-eahq

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Highway and Transit Corridors in City of San Francisco

Caltrans Right of Way
City of San Francisco Boundary

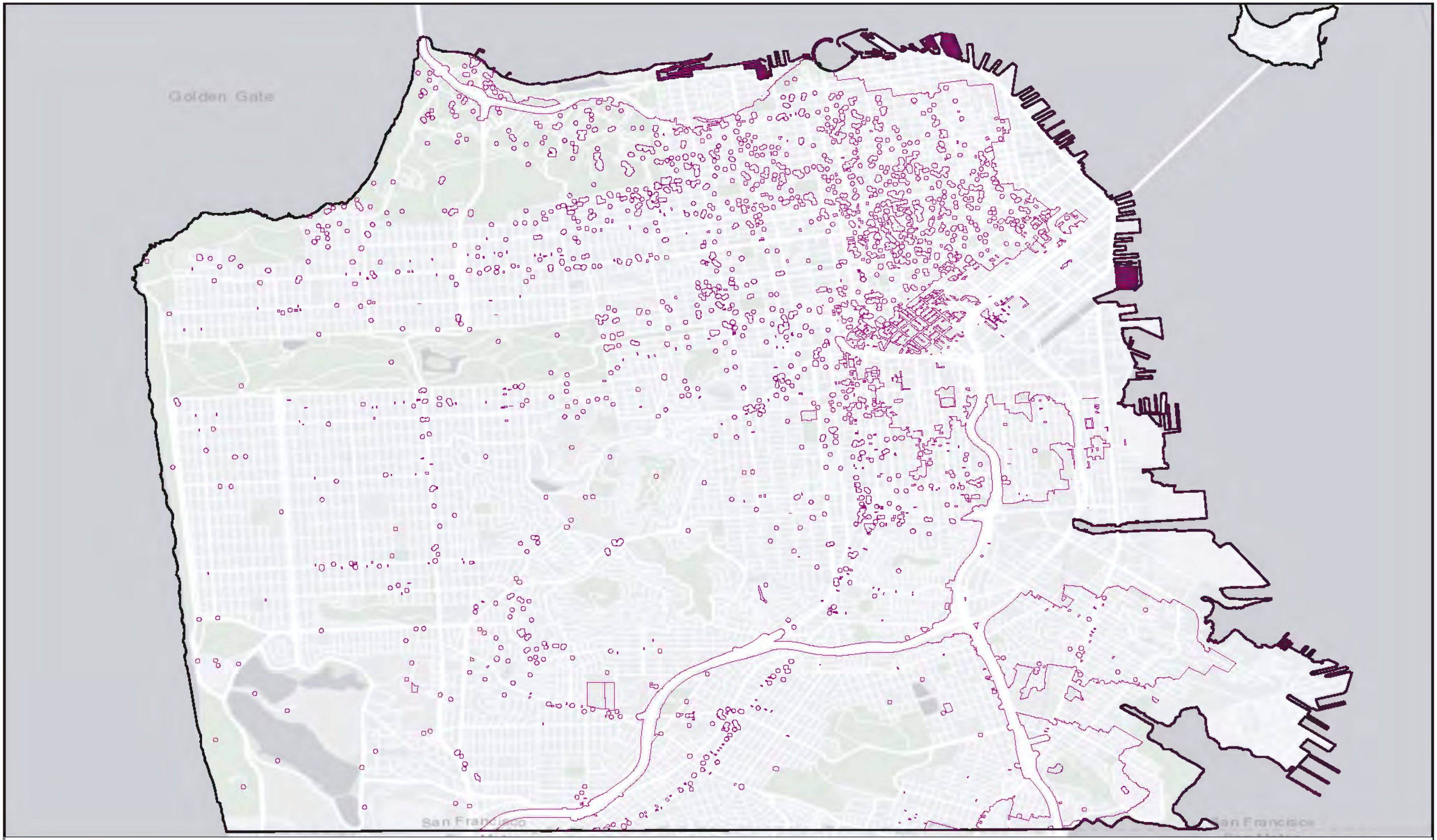
Passenger Railways
BART
Caltrain
MUNI

Passenger Rail Stations
BART
CALTRAIN
San Francisco MUNI

0 0.5 1 Miles

Data Sources:
Caltrans Right of Way: https://caltrans.maps.arcgis.com/apps/webappviewer/index.html?id=04efb9a9f14c4da2aabd9ce36b7dda48/
Passenger Railways: https://opendata.mtc.ca.gov/datasets/passenger-railways-2019
Passenger Rail Stations: https://opendata.mtc.ca.gov/datasets/passenger-rail-stations-2019

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Hazardous Materials Sites

City of San Francisco Boundary

Hazardous Material Sites

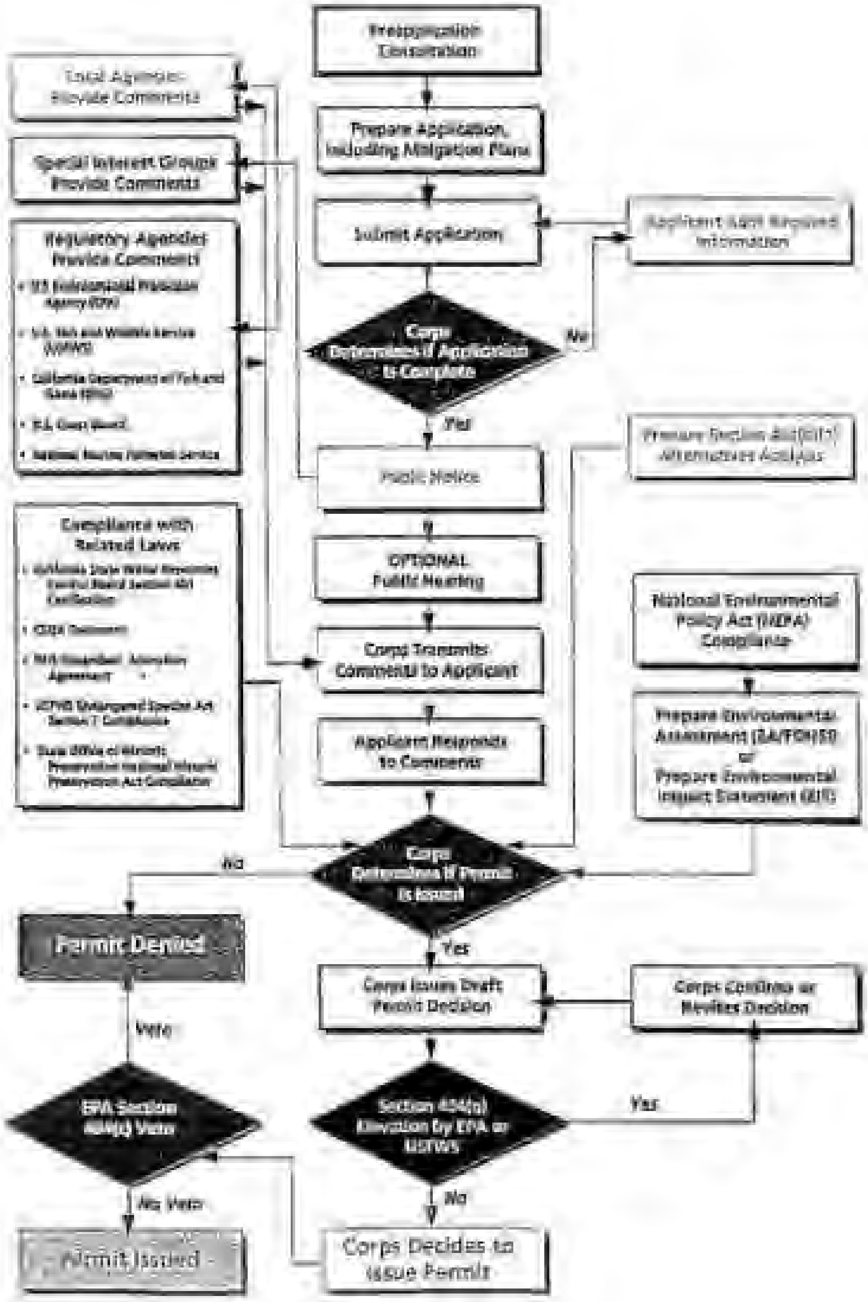
Hazardous Material Sites presents development projects that are located on sites with known or suspected soil and/or groundwater contamination are subject to the provisions of Health Code Article 22A, which is administered by the Department of Public Health.

0 0.5 1 Miles

Data Sources:
City of San Francisco Boundary: https://data.sfgov.org/Geographic-Locations-and-Boundaries/SF-Shoreline-and-Islands/rgcx-5tix
Hazardous Material Sites: https://data.sfgov.org/Energy-and-Environment/Maher/hqsk-4xmh

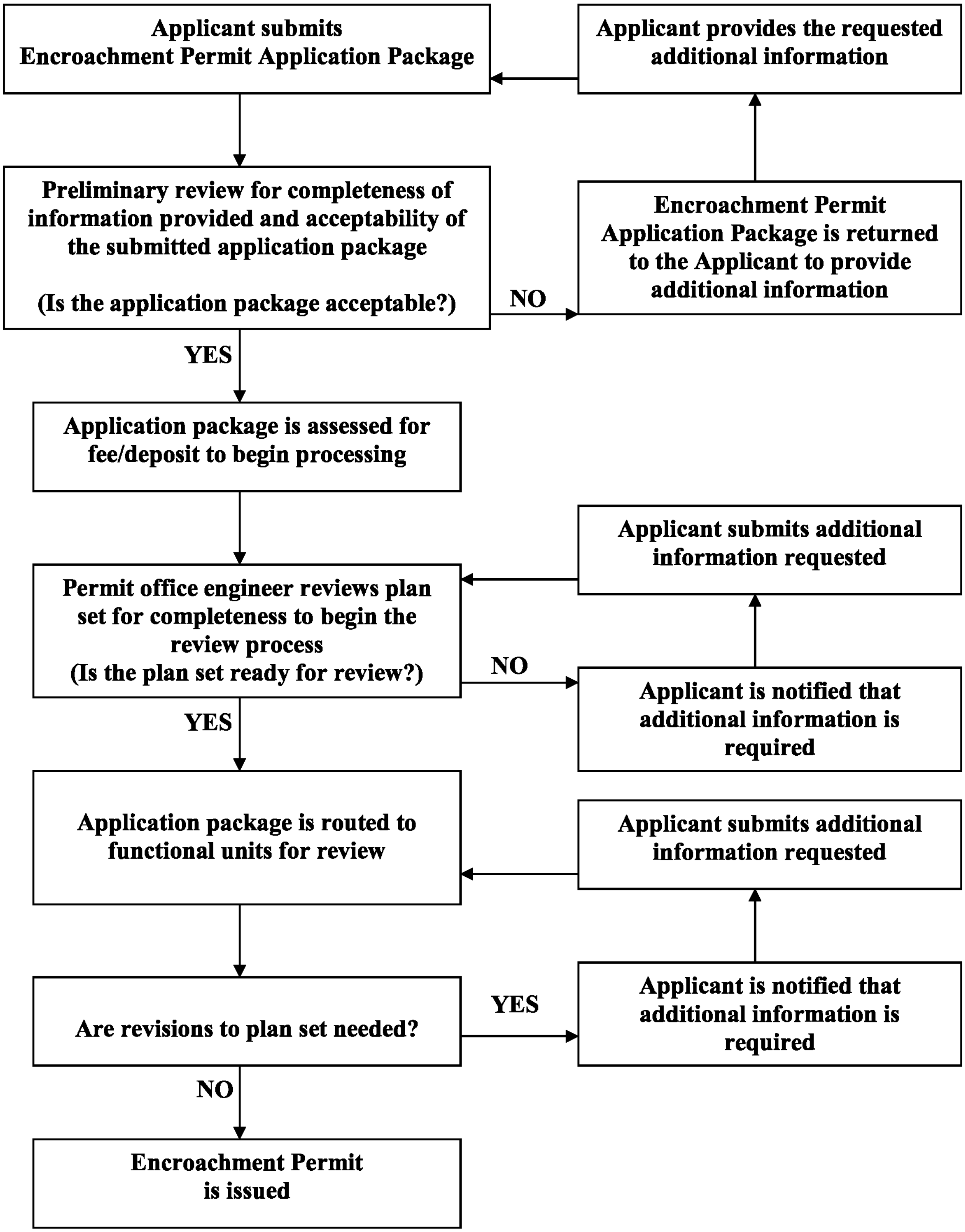
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Appendix B: Regulatory Decision Trees



Preapplication Consultation
Prepare Application, Including Mitigation Plans
Submit Application
Applicant Submits Required Information
Local Agencies Provide Comments
Special Interest Groups Provide Comments
Regulatory Agencies Provide Comments
Corps Determines if Application is Complete
No
Yes
Public Notice
OPTIONAL Public Hearing
Compliance with Related Laws
Corps Transmits Comments to Applicant
Applicant Responds to Comments
Prepare Section 404(b)(1) Alternatives Analysis
National Environmental Policy Act (NEPA) Compliance
Prepare Environmental Assessment (EA/FONSI) or Prepare Environmental Impact Statement (EIS)
Corps Determines if Permit is Issued
No
Yes
Permit Denied
Corps Issues Draft Permit Decision
Corps Confirms or Revises Decision
Veto
EPA Section 404(c) Veto
Section 404(q) Elevation by EPA or USFWS
Yes
No
No Veto
Permit Issued
Corps Decides to Issue Permit

ENCROACHMENT PERMIT APPLICATION REVIEW PROCESS



49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103
www.sfplanning.org

HISTORIC RESOURCE DETERMINATION (HRE)

INFORMATIONAL AND SUPPLEMENTAL APPLICATION PACKET

ATTENTION: A Project Application must be completed and/or attached prior to submitting this Supplemental Application. See the Project Application for instructions.

Pursuant to the California Environmental Quality Act (CEQA), public agencies must review the environmental impacts of proposed projects, including impacts to historic resources. This form provides additional information to assist the Department in analyzing whether a property qualifies as a historic resource under CEQA.

For questions, you can call the Planning counter at 628.652.7300 or email pic@sfgov.org where planners are able to assist you.

Español: Si desea ayuda sobre cómo llenar esta solicitud en español, por favor llame al 628.652.7550. Tenga en cuenta que el Departamento de Planificación requerirá al menos un día hábil para responder.

中文：如果您希望獲得使用中文填寫這份申請表的幫助，請致電628.652.7550。請注意，規劃部門需要至少一個工作日來回應。

Filipino: Kung gusto mo ng tulong sa pagkumpleto ng application na ito sa Filipino, paki tawagan ang 628.652.7550. Paki tandaan na mangangailangan ang Planning Department ng hindi kukulangin sa isang araw na pantrabaho para makasagot.

WHAT IS A HISTORIC RESOURCE DETERMINATION?

The Supplemental Information for Historic Resource Determination provides additional information about a particular property or set of properties that is to be analyzed for historic resource impacts under the California Environmental Quality Act (CEQA). The information requested in this document helps Department staff determine whether a property is a historic resource under CEQA, and if required, the impacts of a proposed project to the historic resource.

WHEN IS A HISTORIC RESOURCE DETERMINATION NECESSARY?

CEQA law requires the Department to analyze a project's impact to any known or potential historical resource. Before the impact of a project can be analyzed, the Department must first determine whether the subject property qualifies as a historical resource. The material requested in this Supplemental Information for Historic Resource Determination provides

Department staff with the documentation for this analysis.

This Application must be submitted when:

1. The project involves an alteration to a structure constructed more than 45 years ago that exceeds the scope of the Categorical Exemption Determination form; or
2. The Department requests this information in order to determine whether a property is a Historic Resource (Category A) or not a Historic Resource (Category C).

Please consult the Property Information Map on the Department's website to determine whether a property has been identified as a CEQA historic resource.

For more information on the CEQA review processes, including the thresholds for full Historic Resource Evaluation review of projects, please refer to the Environmental Evaluation Screening Form found in the Project Application.

HOW DOES THE PROCESS WORK?

If required, the Supplemental Information for Historic Resource Determination must be submitted along with the Project Application. Once the application has been assigned to an Environmental Planner, the information in this document and project details will be forwarded to a Preservation Planner for historic resource review. The Preservation Planner will go through the material and prepare a report analyzing the property against the requirements in CEQA to determine if the building is a historic resource. Once completed, the final report is sent back to the Environmental Planner for other CEQA analysis (if applicable).

INSTRUCTIONS

Please refer to the Environmental Evaluation Screening Form for the instructions on what materials are required for complete CEQA analysis. The attached forms outline the materials that the Preservation Planner must have in order to evaluate whether a property or set of properties is a historic resource under CEQA.

All available resources must be researched and materials gathered from these sources that are relevant to the subject property must be submitted. The CEQA historic resource analysis will not begin until the Department determines that the material submitted is complete. For information on how to compile the required information, refer to the "How to Research a Property's History" section of this document.

Please provide the following materials with this application:

- ☐ Photocopies: Copies are required to be submitted of all documentation used to complete this form, including copies of building permits and drawings, historic maps, and articles.
- ☐ Photographs: The application must be accompanied by unmounted photographs, large enough to show the nature of the property and the adjacent properties and area, but not over 11 X 17 inches.

All documents and other exhibits submitted with this application will be retained as part of the permanent public record in this case.

FEES

Please refer to the Planning Department Fee Schedule available at **www.sfplanning.org** For questions related to the Fee Schedule, you can call the Planning counter at 628.652.7300 or email pic@sfgov.org where planners are able to assist you.

Fees will be determined based on the estimated construction costs. Should the cost of staff time exceed the initial fee paid, an additional fee for time and materials may be billed upon completion of the hearing process or permit approval. Additional fees may also be collected for preparation and recordation of any documents with the San Francisco Assessor-Recorder's office and for monitoring compliance with any conditions of approval.

HOW TO RESEARCH A PROPERTY'S HISTORY

Below is an outline of items that should be researched along with local resources available to the public. Please be aware that the address or block/lot may have changed from the date of construction, so be sure to have all available addresses, block/lot before beginning research.

A. Building Permit History. Start with a search for the full construction and permit history. The Department of Building Inspection (DBI) has copies of all building permits issued, often accompanied by architectural drawings. The original construction permit can tell when a property was built and what its original appearance was. Requests for permit history must be made in person at DBI, 1660 Mission Street, at the Customer Service Division. Please refer to http://

www. sfdbi.org/ for more information.

B. Water Department Records. Now a part of the Public Utilities Commission, the original SF Water Department's records can indicate when a building was constructed if the original building permits are not available. These records show when a property was 'tapped' into the City's main water system and typically occurred close to the construction date. These records should be investigated for any property that was constructed prior to 1906. The Water Department Records are available at the Main Branch of the San Francisco Public Library located at 100 Larkin Street.

C. Assessor-Recorder's Office. Used when researching the ownership history of a property, the Assessor- Recorder's Office has original deeds, sales records, and map books that show ownership history, records about owners, room counts, and building construction dates. Other data available at the Assessor-Recorder's Office include Map Books and Homestead Maps, both of which should be consulted for properties constructed prior to 1912. Research must be done in person at the Assessor-Recorder's Office located in City Hall, Room #190. For more information about the Assessor-Recorder's Officeand the material located there, refer to http://www. sfassessor.org.

D. San Francisco History Room. Located at the Main Branch of the Public Library, the San Francisco History Room has extensive records that are helpful when researching the history of an owner/occupant(s) of a property, the history of a neighborhood, and information on an architect or builder. The San Francisco Historical Photograph Collection is located within the History Room and may provide an early view of a building or street. The collection in the History Room is where historic newspapers, such as the Chronicle and the Examiner, can be researched, along with Our Society Blue Books, and various real estate circulars. The Library also publishes "How to Research a San Francisco Building" that lists all resources available as well as steps to take when researching a property. The Main Branch of the San Francisco Public Library is located at 100 Larkin Street and additional information on the SF History Room is available on the library's website. Please refer to http://www.sfpl.org/.

E. Other Data at the Main Branch of San Francisco Public Library. There are two additional resources that should be consulted when researching a property's history - the City Directories and U.S. Census Records. These resources are useful for documenting a building's occupant history. For information on researching census records, refer to the Government Information Center division of the Library; the City Directories are a part of the General Collection. The Main Branch of the San Francisco Public Library is located at 100 Larkin Street and additional information on both Library sections are available on the library's website. Please refer to http://www.sfpl.org/.

F. Other Research Collections. There are several other resources available for researching a property's history.

- The California Historical Society houses extensive collections of historic photographs, histories of peoples and neighborhoods in San Francisco. For more information about the Society and their library hours, please refer to http://www. californiahistoricalsociety.org.
- The Environmental Design Library at UC Berkley is one of the premier repositories for architecture, landscape architecture, regional and urban planning materials in the country. The collections include periodicals such as Architectural Record and Architect & Engineer, original architectural drawings by premier architects, and rare books. For more information on the Library and its hours, please refer to http://www.lib.berkeley.edu/ENVI/.
- San Francisco Architectural Heritage is a local organization whose mission is "to preserve and enhance San Francisco's unique architectural and cultural identity." SF Heritage has a library collection that focuses on historic buildings and includes a variety of material including newspaper articles and architect biographies. For more information about SF Heritage, please refer to http://www.sfheritage.org/.

If required, this Supplemental Information for a Historic Resource Determination must be submitted along with the *Project Application.*

PLANNING APPLICATION RECORD NUMBER

San Francisco Planning

HISTORIC RESOURCE DETERMINATION (HRE)

SUPPLEMENTAL APPLICATION

Property Information

Project Address: Block/Lot(s):

Date of Construction: Architect or Builder:

Is property included in a historic survey? Survey Name: Survey Rating:

☐ Yes ☐ No

Designated Property: ☐ Article 10 or Article 11 ☐ CA Register ☐ National Register

Permit History Table

Please list out all building permit issued from the date of construction to present. Attach photocopies of each.

Permit:	Date	Description of Work
1		
2		
3		
4		
5		
6		
7		
8		

Please describe any additional projects or information about a particular project(s) that is not included in this table:

Ownership History Table

Please list out all owners of the property from the date of construction to present

Owner:	Date (to-from):	Name(s):	**Occupation:**
1			
2			
3			
4			
5			
6			
7			
8			

Please describe any additional owners or information about a particular owner(s) that is not included in this table:

☐ *See attachment (if more space is needed)*

Occupant History Table

Please list out all occupants/tenants of the property from the date of construction to present.

Occup.	Date (to-from):	Name(s):	**Occupation:**
1			
2			
3			
4			
5			
6			
7			
8			

Please describe any additional occupants or information about a particular occupant(s) that is not included in this table:

☐ *See attachment (if more space is needed)*

Property/Architecture Description

Please provide a detailed narrative describing the existing building and any associated buildings on the property. Be sure to describe the architectural style and include descriptions of the non-visible portions of the building. Attach photographs of the building and property, including the rear facade.

Adjacent Properties/Neighborhood Description

Please provide a detailed narrative describing the adjacent buildings and the buildings on the subject block and the block directly across the street from the subject property. Be sure to describe the architectural styles. Attach photographs of all properties.

APPLICANT'S AFFIDAVIT

Under penalty of perjury the following declarations are made:

a) The undersigned is the owner or authorized agent of the owner of this property.

b) The information presented is true and correct to the best of my knowledge.

c) Other information or applications may be required.

d) I hereby authorize City and County of San Francisco Planning staff to conduct a site visit of this property as part of the City's review of this application, making all portions of the interior and exterior accessible through completion of construction and in response to the monitoring of any condition of approval.

e) I attest that personally identifiable information (PII) - i.e. social security numbers, driver's license numbers, bank accounts - have not been provided as part of this application. Furthermore, where supplemental information is required by this application, PII has been redacted prior to submittal to the Planning Department. I understand that any information provided to the Planning Department becomes part of the public record and can be made available to the public for review and/or posted to Department websites.

______________________________ ______________________________

Signature Name (Printed)

____

Date

______________ ______________ ______________________________

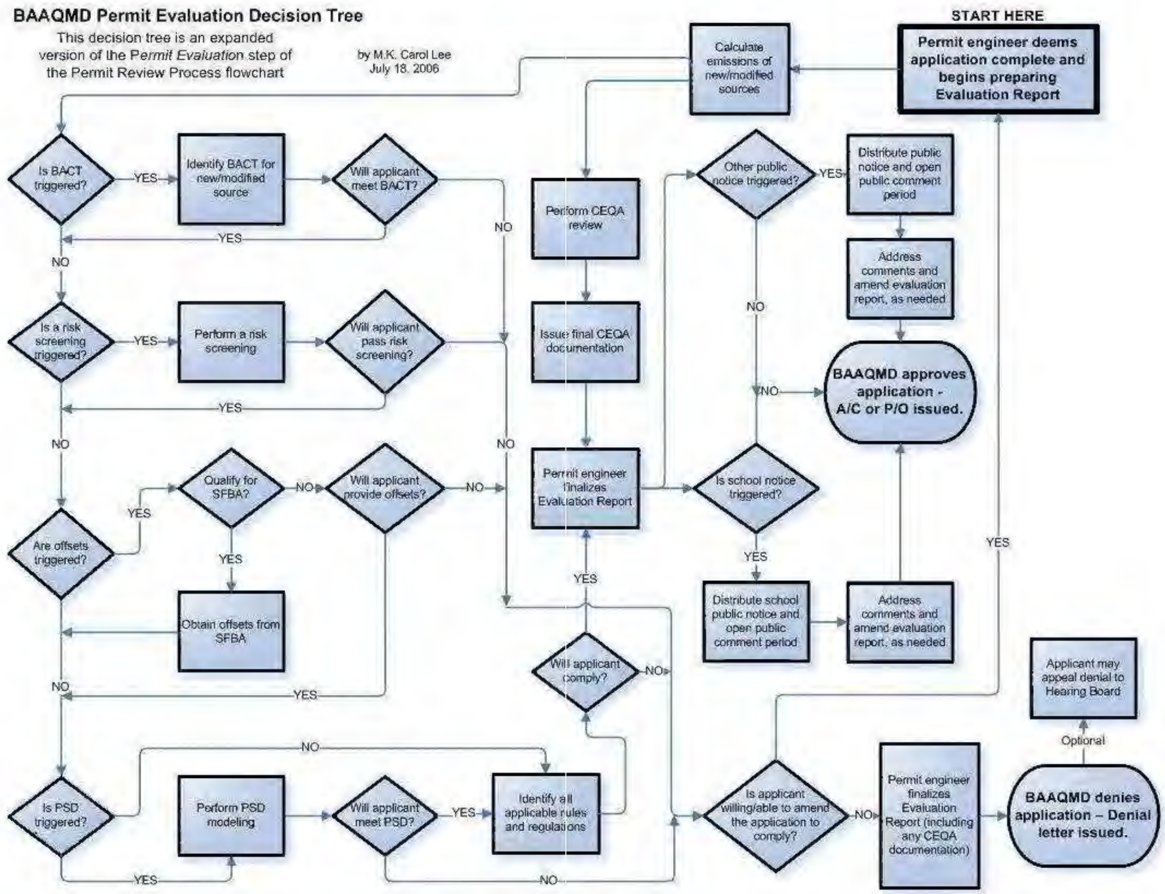
Relationship to Project Phone Email

(i.e. Owner, Architect, etc.)

For Department Use Only

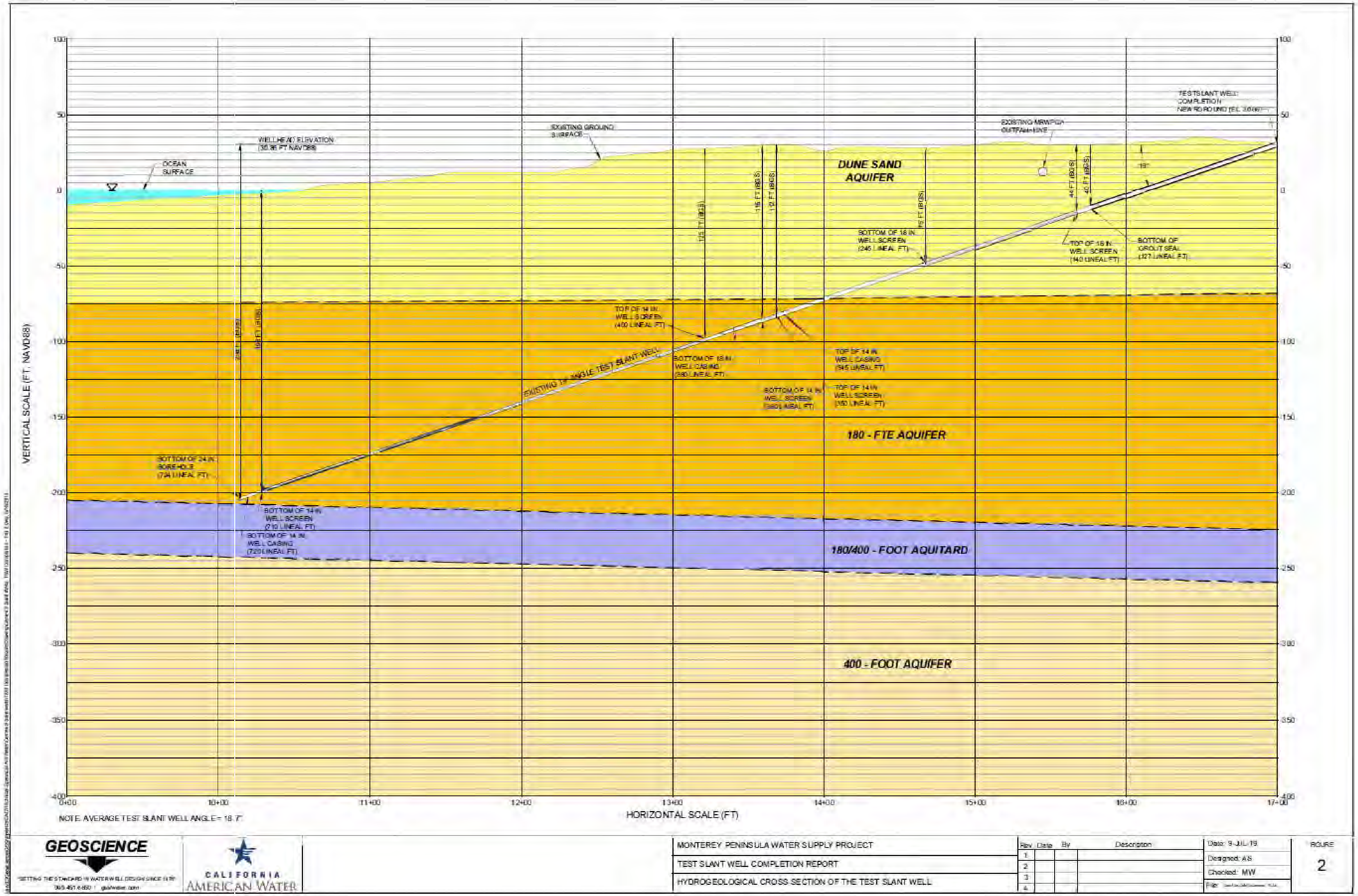
Application received by Planning Department:

By: ______________________________ Date: ______________________


BAAQMD Permit Evaluation Decision Tree
This decision tree is an expanded version of the Permit Evaluation step of the Permit Review Process flowchart
by M.K. Carol Lee
July 18, 2006
START HERE
Permit engineer deems application complete and begins preparing Evaluation Report
Calculate emissions of new/modified sources
Is BACT triggered?
Identify BACT for new/modified source
Will applicant meet BACT?
Perform CEQA review
Other public notice triggered?
Distribute public notice and open public comment period
Address comments and amend evaluation report, as needed
Is a risk screening triggered?
Perform a risk screening
Will applicant pass risk screening?
Issue final CEQA documentation
BAAQMD approves application - A/C or P/O issued.
Qualify for SFBA?
Will applicant provide offsets?
Permit engineer finalizes Evaluation Report
Is school notice triggered?
Are offsets triggered?
Obtain offsets from SFBA
Distribute school public notice and open public comment period
Address comments and amend evaluation report, as needed
Will applicant comply?
Applicant may appeal denial to Hearing Board
Optional
Is PSD triggered?
Perform PSD modeling
Will applicant meet PSD?
Identify all applicable rules and regulations
Is applicant willing/able to amend the application to comply?
Permit engineer finalizes Evaluation Report (including any CEQA documentation)
BAAQMD denies application – Denial letter issued.
YES
NO

Appendix C: Maps and Figures

Slant Well Elevation Detail



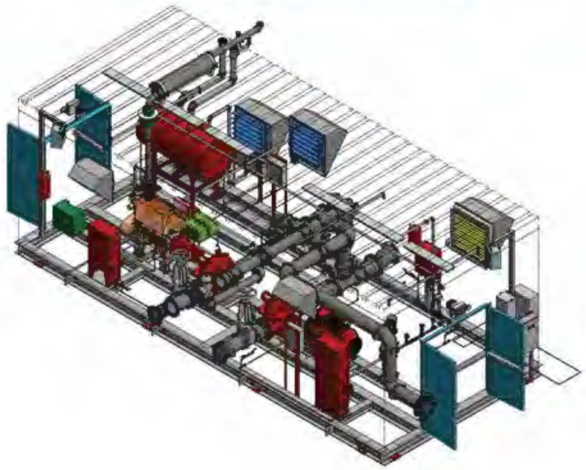
Source: CalAm Monterey Peninsula Water Supply Project

Appendix D: Pump Station Conceptual Configurations & Layouts

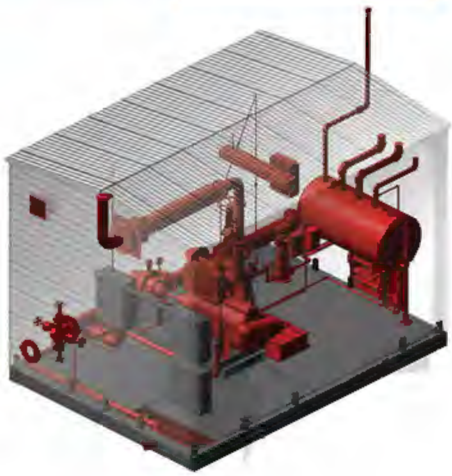
Conceptual Configurations for 3,000-6,000 gpm Capacity "Package" Stations

Source: www.ruhrpumpen.com

Source: www.ruhrpumpen.com

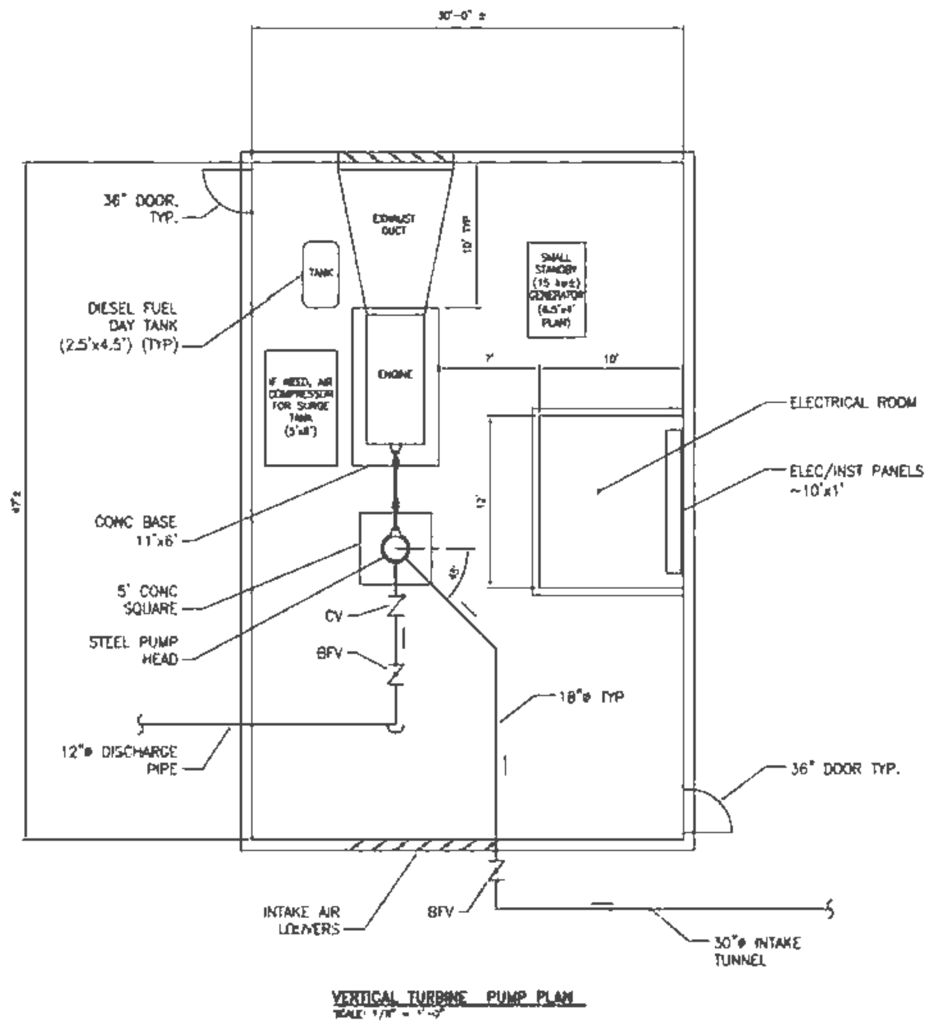


Source: www.ruhrpumpen.com

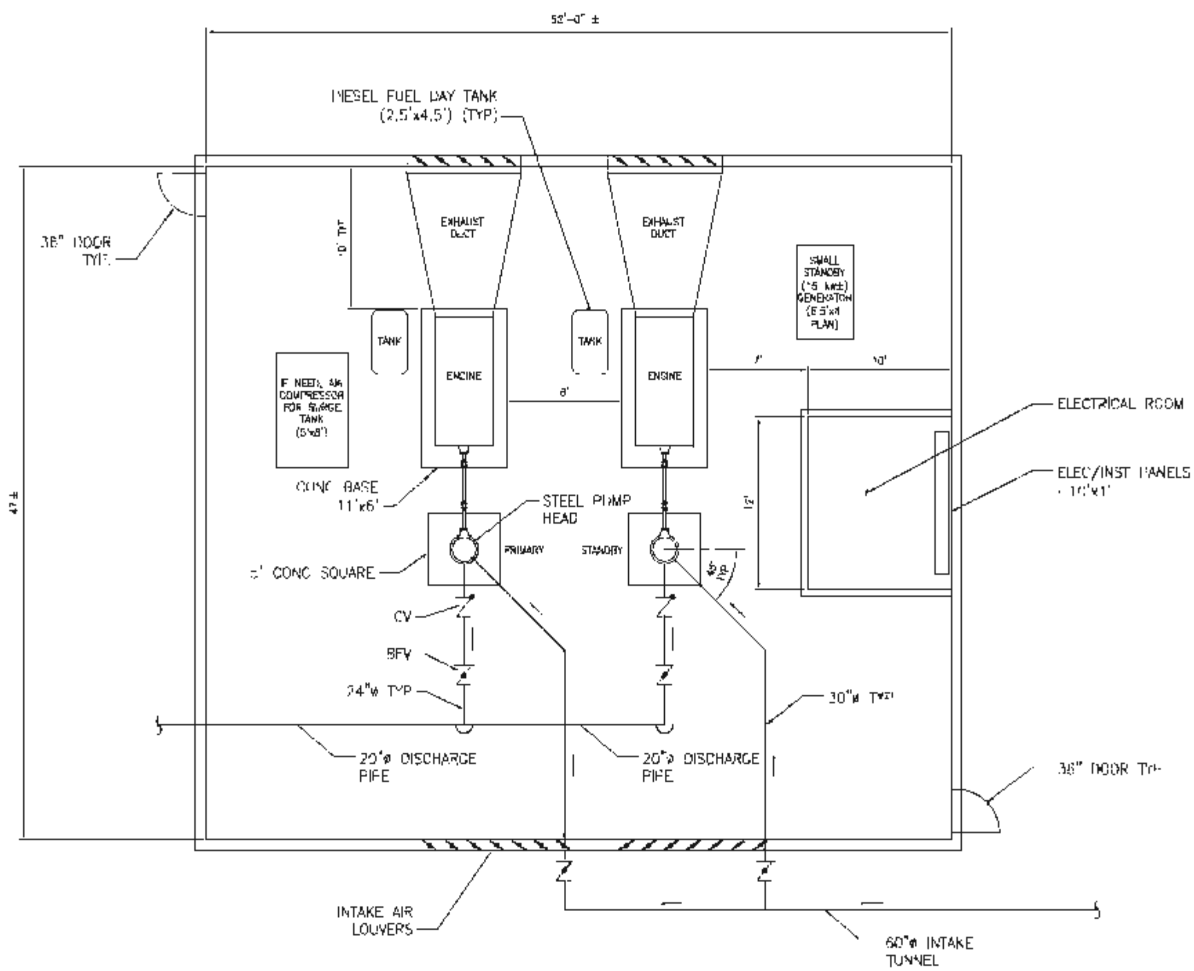


Source: www.armstrongintegrated.com

Conceptual Plan for “Traditional” 3,000 or 6,000 gpm Capacity Seawater Pump Station

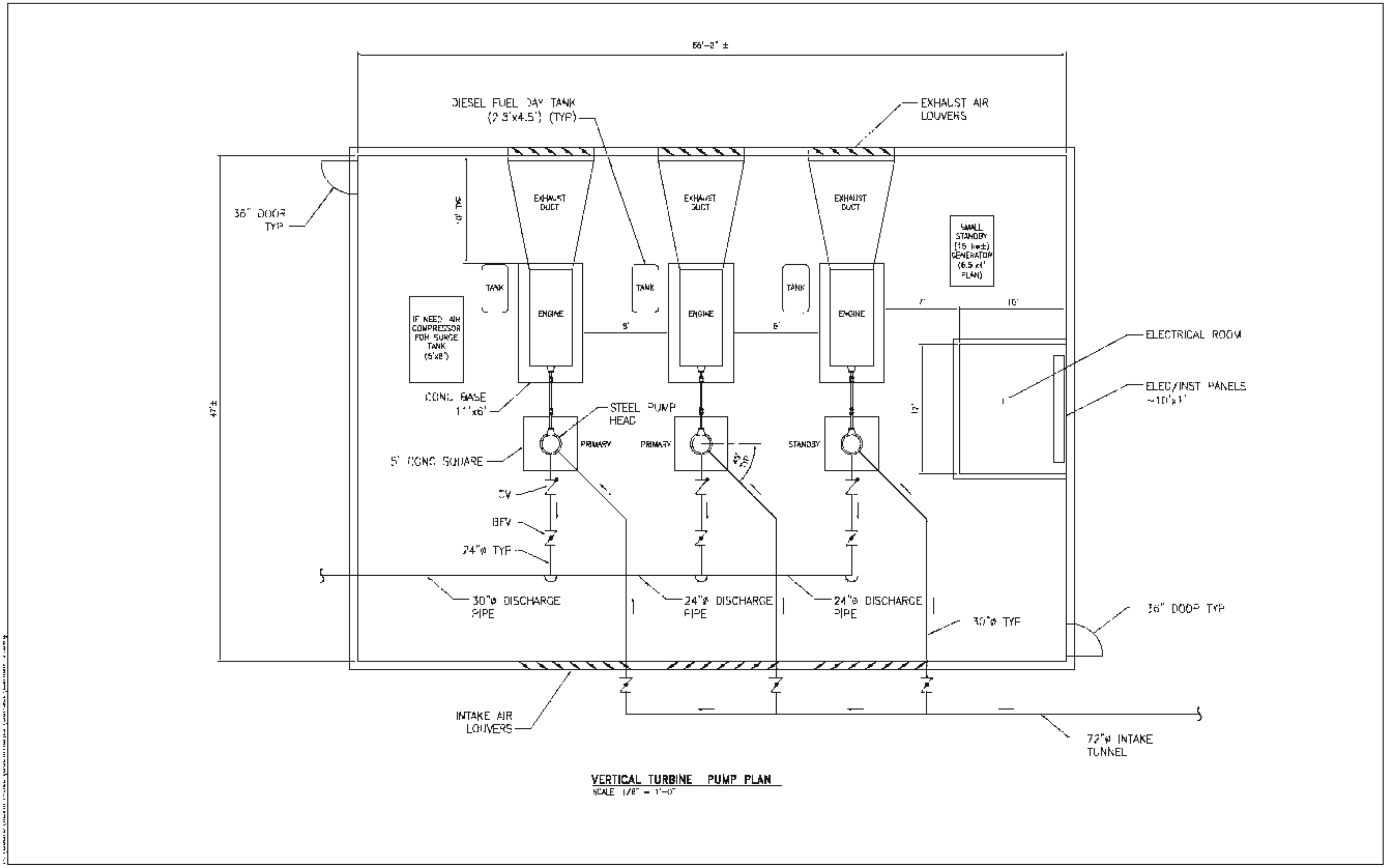


Conceptual Plan for "Traditional" 10,000-gpm Capacity Seawater Pump Station

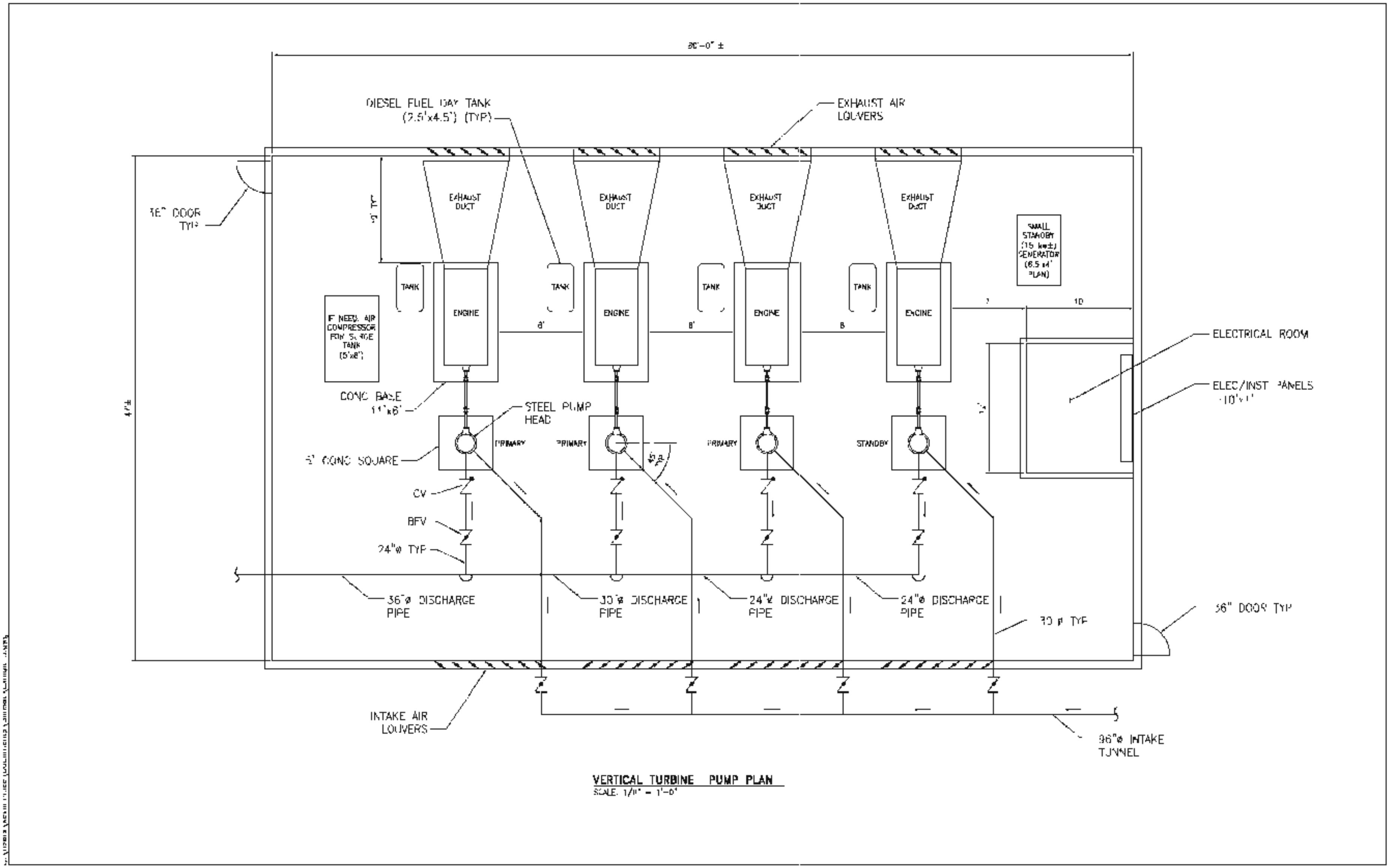


VERTICAL TURBINE PUMP PLAN

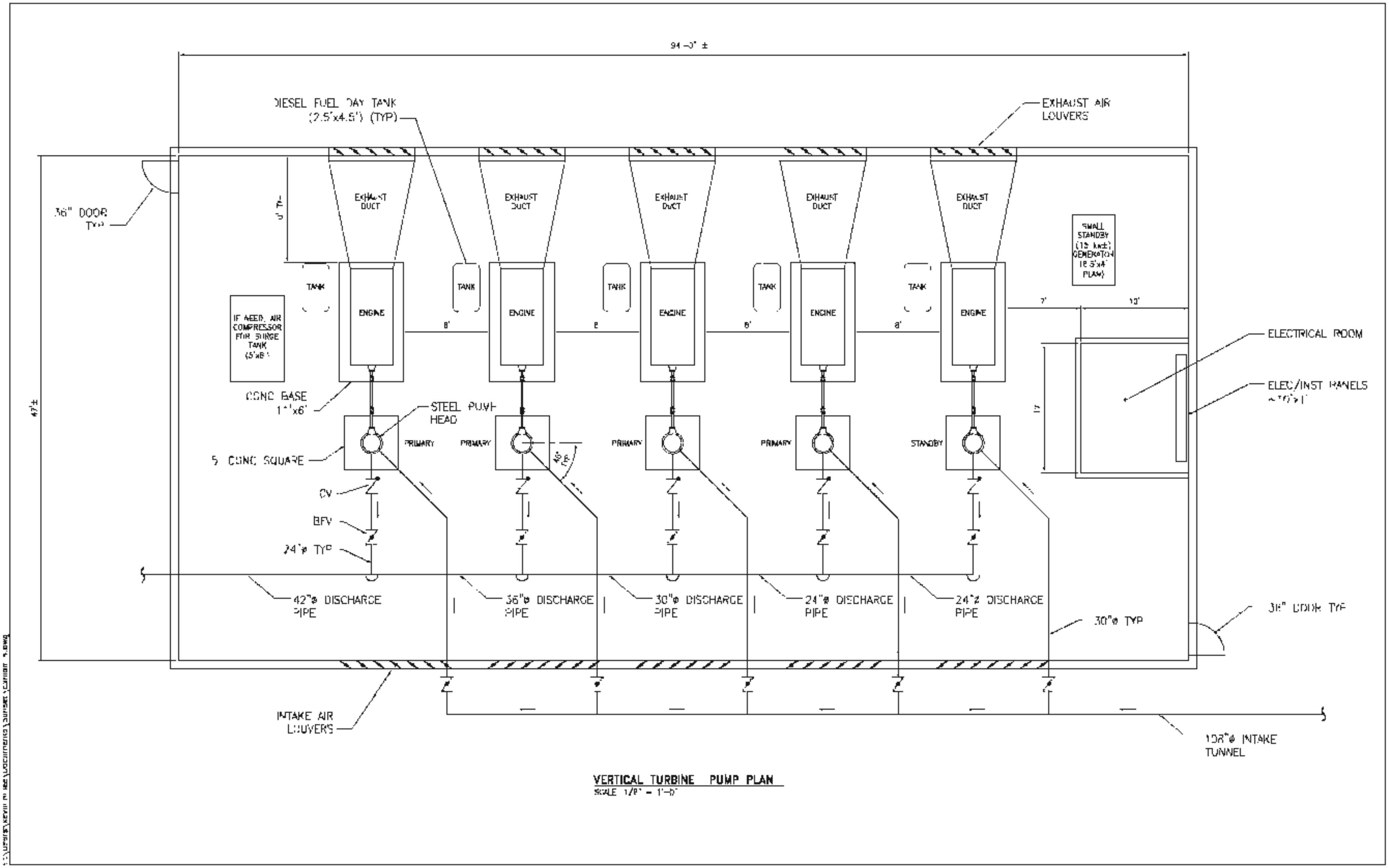
Conceptual Plan for "Traditional" 20,000-gpm Capacity Seawater Pump Station



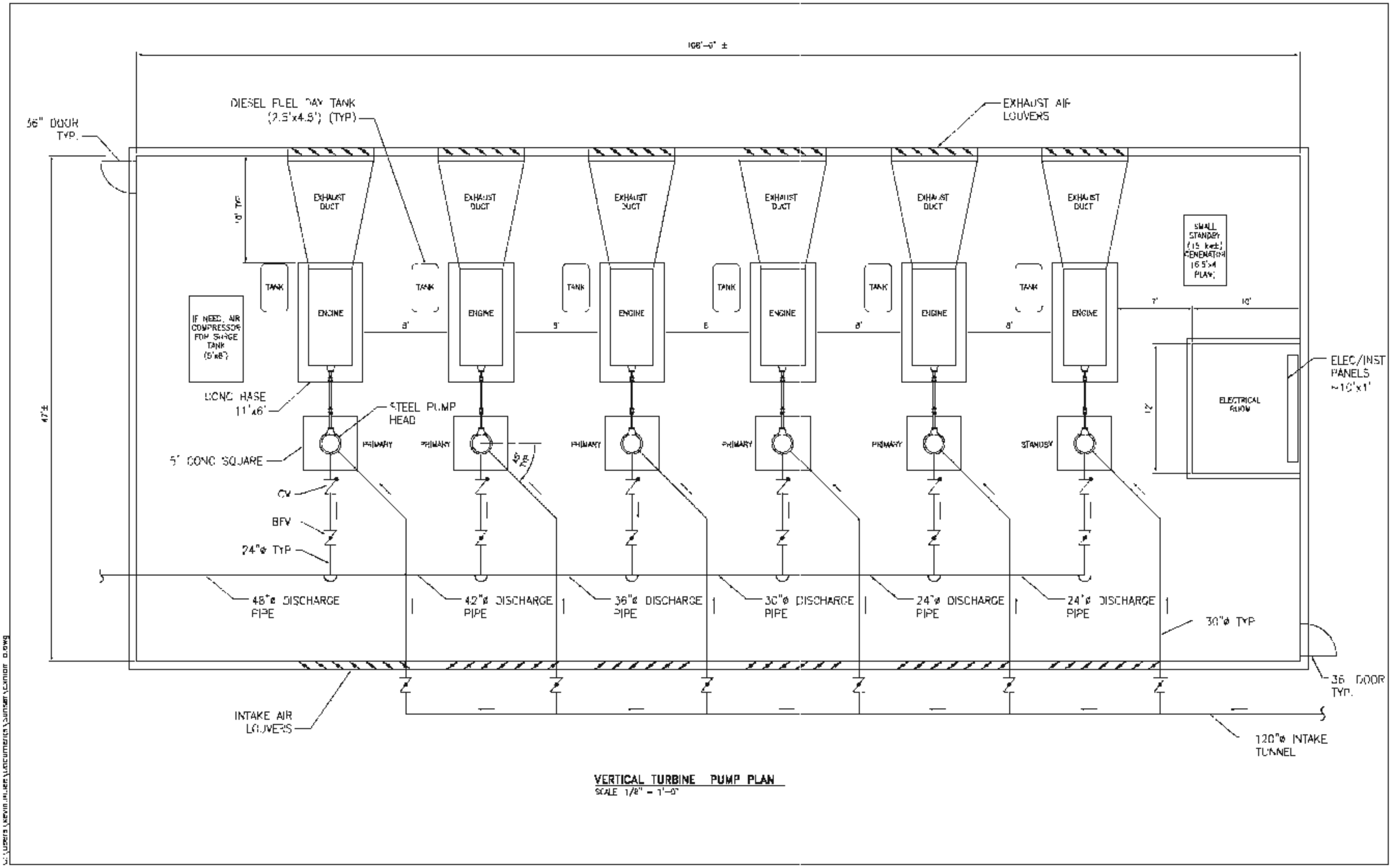
Conceptual Plan for “Traditional” 30,000-gpm Capacity Seawater Pump Station



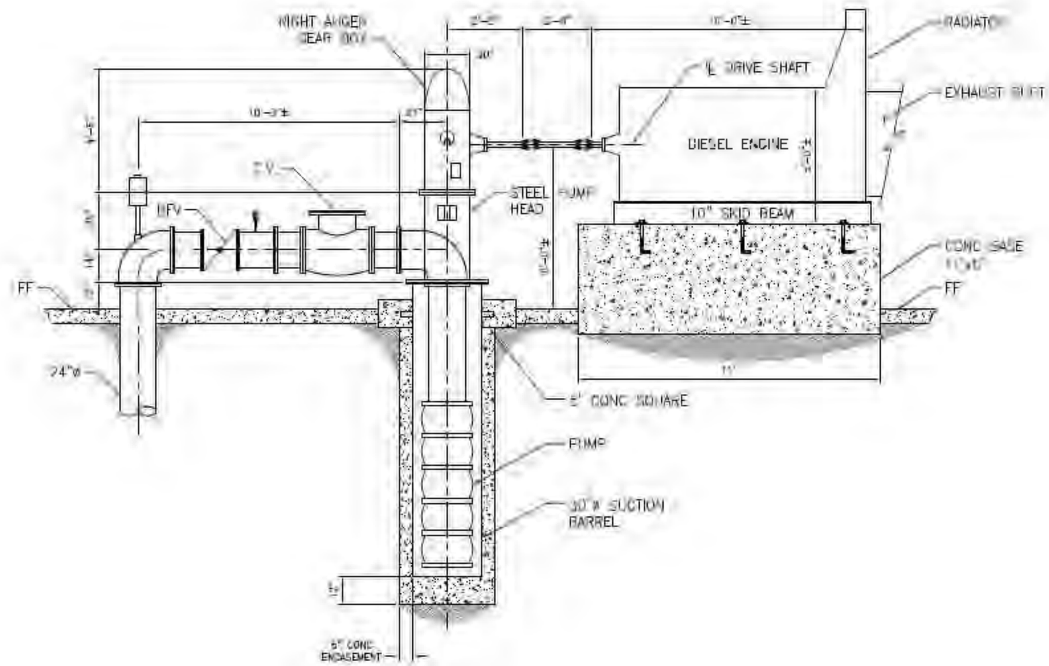
Conceptual Plan for "Traditional" 40,000-gpm Capacity Seawater Pump Station



Conceptual Plan for “Traditional” 50,000-gpm Capacity Seawater Pump Station

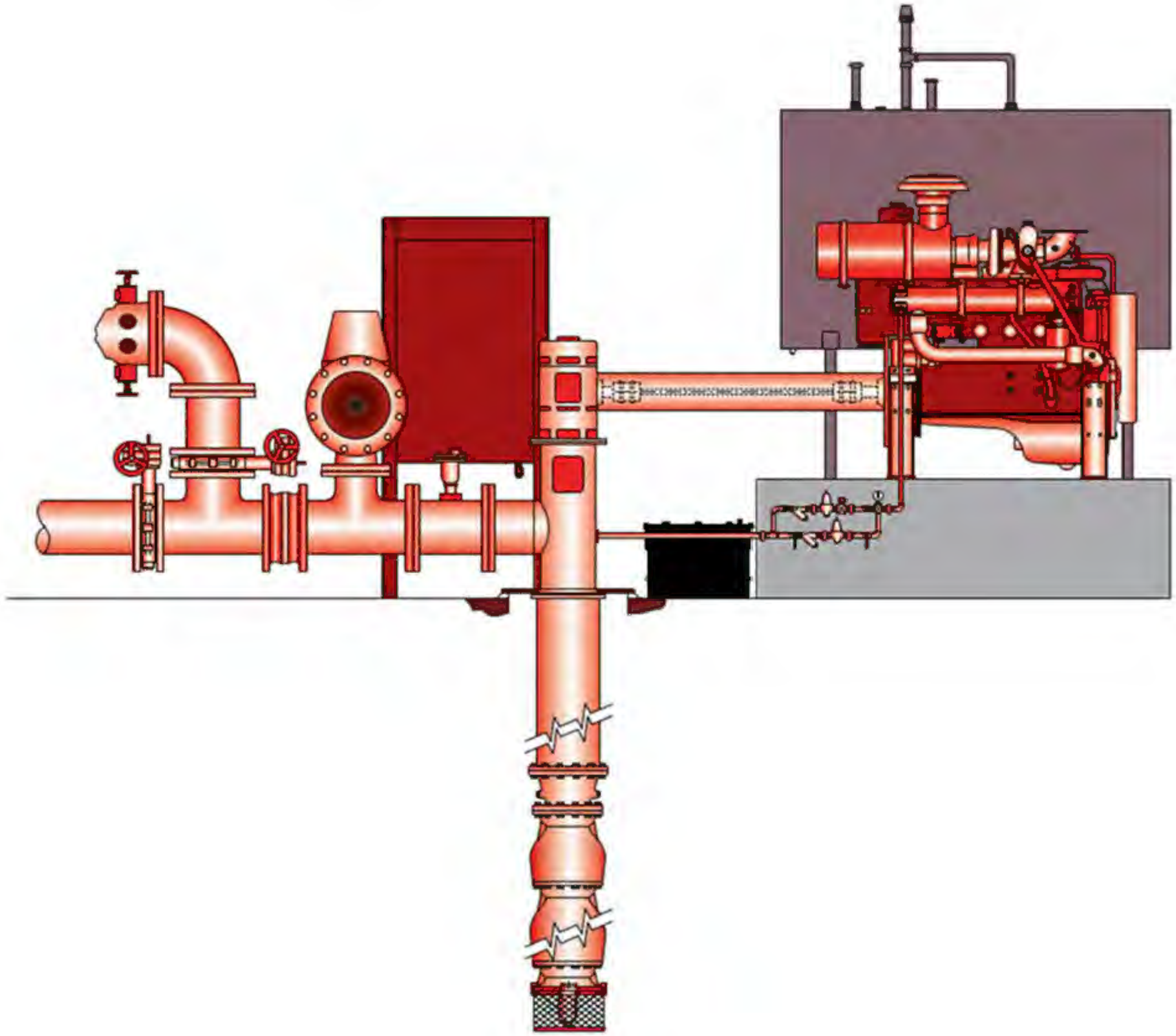


Conceptual Cross Section for “Traditional” Pump Assemblies

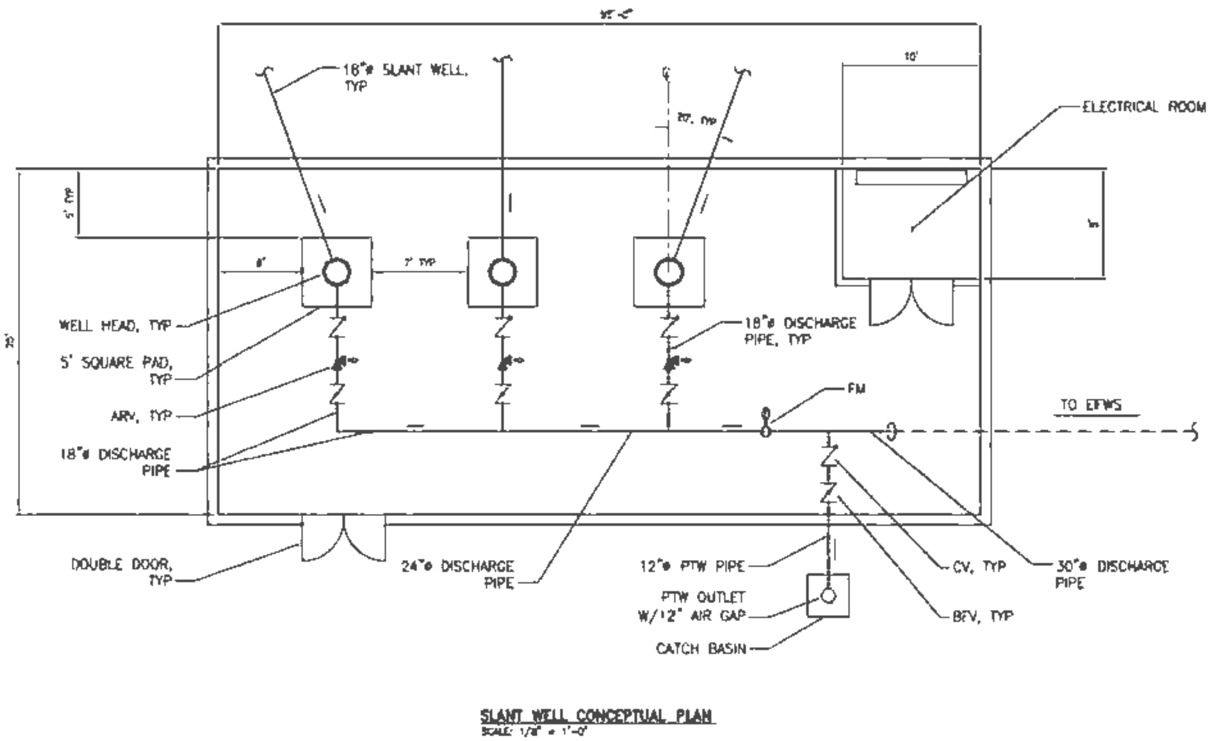


VERTICAL TURBINE PUMP/DRIVE SECTION

Rendering of Conceptual Vertical Turbine Pump



Conceptual Plan for 9,000-gpm Capacity Slant Well Seawater Pump Station



Appendix E: Cost Estimates

3,000 gpm PS

Engineering Parameters

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	18	18	14	14	14	14	14	12	12	
Intake Tunnel Diameter (inches)	NA	30	NA	30	30	NA	30	30	30	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	15	NA	15	15	NA	15	15	15	
Pump Station/Wellhead Building Size (sf)	1,375	1,410	1,375	1,410	1,410	1,375	1,410	1,410	1,410	Assumed wellhead building dimensions of 55 ft x 25 ft; pump station building dimensions of 47 ft x 30 ft. Wellhead buildings assumed spaced min of ~750 ft apart.
Number of Pumps	1	1	1	1	1	1	1	1	1	
Number of Wellhead Bldgs	1	NA	1	NA	NA	1	NA	NA	NA	
Number of Screen Modules	NA	1	NA	1	1	NA	1	1	1	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	2,500	3,700	2,500	3,700	3,700	2,500	3,700	3,700	3,700	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water	notes
Land Purchase	$975,000	$1,443,000	$975,000	$1,443,000	$1,443,000	$975,000	$1,443,000	$2,405,000	$2,405,000	based on land area req'd & unit rate; updated per communication w/ D. Brasil, 4/15/21
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$6,000,000	$6,500,000	$6,000,000	$6,500,000	$6,500,000	$6,000,000	$6,500,000	$5,500,000	$5,500,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	assumed
Intake Screens	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000	assume
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$20,000,000	NA	$20,000,000	$15,000,000	NA	$15,000,000	$2,000,000	$2,000,000	Based on updated lengths in row 16
Vertical Excavation	NA	$1,300,000	NA	$1,300,000	$5,800,000	NA	$1,300,000	$900,000	$900,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$3,000,000	NA	$3,000,000	NA	NA	$3,000,000	NA	NA	NA	
Pumps (equipment)	$500,000	$800,000	$500,000	$800,000	$800,000	$500,000	$800,000	$800,000	$800,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$2,250,000	$7,800,000	$2,250,000	$7,800,000	$7,800,000	$2,250,000	$7,800,000	$7,800,000	$7,800,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$20,400,000	$20,400,000	$19,800,000	$19,800,000	$19,800,000	$13,500,000	$13,500,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$5,600,000	$7,700,000	$7,700,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$4,600,000	$4,600,000	$3,500,000	$3,500,000	$2,600,000	$2,600,000	$2,600,000	$400,000	$400,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$40,700,000	$68,300,000	$39,000,000	$66,600,000	$70,300,000	$39,000,000	$61,600,000	$24,000,000	$24,900,000	

* State Lands Lease, ROW Crossings,

** soft costs included in items above

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Environmental / Permitting / Land Acq.	$7,975,000	$8,943,000	$7,975,000	$8,943,000	$8,943,000	$7,975,000	$8,943,000	$8,905,000	$8,905,000
Pump Station	$7,650,000	$34,300,000	$7,650,000	$34,300,000	$33,300,000	$7,150,000	$28,800,000	$14,200,000	$14,200,000
Piping	$25,000,000	$25,000,000	$23,300,000	$23,300,000	$28,000,000	$23,800,000	$23,800,000	$850,000	$1,750,000
TOTAL (rounded up)	$40,700,000	$68,300,000	$39,000,000	$66,600,000	$70,300,000	$39,000,000	$61,600,000	$24,000,000	$24,900,000

Lifecycle Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Initial Cost	$40,700,000	$68,300,000	$39,000,000	$66,600,000	$70,300,000	$39,000,000	$61,600,000	$24,000,000	$24,900,000
Annual ODC / Fuel / Fixed Costs	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000
Annual Staffing Cost	$36,000	$90,000	$36,000	$90,000	$90,000	$36,000	$90,000	$90,000	$90,000
Slant Well Renewal *	$3,000,000	NA	$3,000,000	NA	NA	$3,000,000	NA	NA	NA
Slant Well Pump Replacement *	$500,000	NA	$500,000	NA	NA	$500,000	NA	NA	NA
Intake Screen Replacement *	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000
NPV @ 4% Interest	$55,700,000	$79,700,000	$54,000,000	$78,000,000	$81,700,000	$54,000,000	$73,000,000	$35,400,000	$36,300,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life

*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Staff Required for routine O&M (FTE)	0.2	0.5	0.2	0.5	0.5	0.2	0.5	0.5	0.5

6,000 gpm PS

Engineering Parameters

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	24	24	18	18	18	18	18	18	16	
Intake Tunnel Diameter (inches)	NA	42	NA	42	42	NA	42	42	42	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	15	NA	15	15	NA	15	15	15	
Pump Station/Wellhead Building Size (sf)	1,375	1,410	1,375	1,410	1,410	1,375	1,410	1,410	1,410	Assumed wellhead building dimensions of 55 ft x 25 ft; pump station building dimensions of 47 ft x 30 ft. Wellhead buildings assumed spaced min of ~750 ft apart.
Number of Pumps	2	1	2	1	1	2	1	1	1	
Number of Wellhead Bldgs	1	NA	1	NA	NA	1	NA	NA	NA	
Number of Screen Modules	NA	1	NA	1	1	NA	1	1	1	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	2,500	3,700	2,500	3,700	3,700	2,500	3,700	3,700	3,700	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs

Land Purchase	$975,000	$1,443,000	$975,000	$1,443,000	$1,443,000	$975,000	$1,443,000	$2,405,000	$2,405,000	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$6,250,000	$6,750,000	$6,250,000	$6,750,000	$6,750,000	$6,250,000	$6,750,000	$5,750,000	$5,750,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	assumed
Intake Screens	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000	assume
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$20,000,000	NA	$20,000,000	$15,000,000	NA	$15,000,000	$2,000,000	$2,000,000	Based on updated lengths in row 16
Vertical Excavation	NA	$1,300,000	NA	$1,300,000	$5,800,000	NA	$1,300,000	$900,000	$900,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$6,000,000	NA	$6,000,000	NA	NA	$6,000,000	NA	NA	NA	
Pumps (equipment)	$1,000,000	$1,600,000	$1,000,000	$1,600,000	$1,600,000	$1,000,000	$1,600,000	$1,600,000	$1,600,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$2,250,000	$7,800,000	$2,250,000	$7,800,000	$7,800,000	$2,250,000	$7,800,000	$7,800,000	$7,800,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$25,500,000	$25,500,000	$26,400,000	$26,400,000	$26,400,000	$18,000,000	$18,000,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$5,600,000	$7,700,000	$7,700,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$5,700,000	$5,700,000	$4,600,000	$4,600,000	$3,500,000	$3,500,000	$3,500,000	$500,000	$400,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$50,600,000	$75,500,000	$50,400,000	$75,300,000	$78,800,000	$48,100,000	$68,000,000	$25,200,000	$26,000,000	

* State Lands Lease, ROW Crossings,

** soft costs included in items above

Environmental / Permitting / Land Acq.	$8,225,000	$9,193,000	$8,225,000	$9,193,000	$9,193,000	$8,225,000	$9,193,000	$9,155,000	$9,155,000
Pump Station	$11,150,000	$35,100,000	$11,150,000	$35,100,000	$34,100,000	$10,650,000	$29,600,000	$15,000,000	$15,000,000
Piping	$31,200,000	$31,200,000	$31,000,000	$31,000,000	$35,500,000	$29,200,000	$29,200,000	$950,000	$1,750,000
TOTAL (rounded up)	$50,600,000	$75,500,000	$50,400,000	$75,300,000	$78,800,000	$48,100,000	$68,000,000	$25,200,000	$26,000,000

Lifecycle Costs

Initial Cost	$50,600,000	$75,500,000	$50,400,000	$75,300,000	$78,800,000	$48,100,000	$68,000,000	$25,200,000	$26,000,000
Annual ODC / Fuel / Fixed Costs	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000
Annual Staffing Cost	$36,000	$90,000	$36,000	$90,000	$90,000	$36,000	$90,000	$90,000	$90,000
Slant Well Renewal *	$6,000,000	NA	$6,000,000	NA	NA	$6,000,000	NA	NA	NA
Slant Well Pump Replacement *	$1,000,000	NA	$1,000,000	NA	NA	$1,000,000	NA	NA	NA
Intake Screen Replacement *	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000
NPV @ 4% Interest	$72,600,000	$86,900,000	$72,400,000	$86,700,000	$90,200,000	$70,100,000	$79,400,000	$36,600,000	$37,400,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life

*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

Staff Required for routine O&M (FTE)	0.2	0.5	0.2	0.5	0.5	0.2	0.5	0.5	0.5

10,000 gpm PS

Engineering Parameters

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	30	30	24	24	24	20	20	20	20	
Intake Tunnel Diameter (inches)	NA	60	NA	60	60	NA	60	60	60	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	35	NA	35	35	NA	35	35	35	
Pump Station/Wellhead Building Size (sf)	1,375	2,444	1,375	2,444	2,444	1,375	2,444	2,444	2,444	Assumed wellhead building dimensions of 55 ft x 25 ft. Assumed spaced min of ~750 ft apart.
Number of Pumps	6	2	6	2	2	6	2	2	2	
Number of Wellhead Bldgs	3	NA	3	NA	NA	3	NA	NA	NA	
Number of Screen Modules	NA	1	NA	1	1	NA	1	1	1	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	7,500	10,400	7,500	10,400	10,400	7,500	10,400	10,400	10,400	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs

Land Purchase	$2,925,000	$4,056,000	$2,925,000	$4,056,000	$4,056,000	$2,925,000	$4,056,000	$6,760,000	$6,760,000	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$6,500,000	$7,000,000	$6,500,000	$7,000,000	$7,000,000	$6,500,000	$7,000,000	$6,000,000	$6,000,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	assumed
Intake Screens	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000	assume
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$20,000,000	NA	$20,000,000	$15,000,000	NA	$15,000,000	$2,000,000	$2,000,000	Based on updated lengths in row 16
Vertical Excavation	NA	$6,900,000	NA	$6,900,000	$31,300,000	NA	$6,900,000	$4,700,000	$4,700,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$18,000,000	NA	$18,000,000	NA	NA	$18,000,000	NA	NA	NA	
Pumps (equipment)	$3,000,000	$5,200,000	$3,000,000	$5,200,000	$5,200,000	$3,000,000	$5,200,000	$5,200,000	$5,200,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$6,750,000	$13,600,000	$6,750,000	$13,600,000	$13,600,000	$6,750,000	$13,600,000	$13,600,000	$13,600,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$30,600,000	$30,600,000	$33,000,000	$33,000,000	$31,100,000	$18,100,000	$18,100,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$5,600,000	$7,700,000	$7,700,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$6,900,000	$6,900,000	$5,700,000	$5,700,000	$4,300,000	$4,000,000	$4,000,000	$600,000	$600,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$77,600,000	$99,700,000	$78,800,000	$100,900,000	$122,100,000	$69,400,000	$86,500,000	$43,100,000	$44,000,000	

* State Lands Lease, ROW Crossings,
** soft costs included in items above

Environmental / Permitting / Land Acq.	$10,425,000	$12,056,000	$10,425,000	$12,056,000	$12,056,000	$10,425,000	$12,056,000	$13,760,000	$13,760,000
Pump Station	$29,650,000	$50,100,000	$29,650,000	$50,100,000	$69,000,000	$29,150,000	$44,600,000	$28,200,000	$28,200,000
Piping	$37,500,000	$37,500,000	$38,700,000	$38,700,000	$41,000,000	$29,800,000	$29,800,000	$1,050,000	$1,950,000
TOTAL (rounded up)	$77,600,000	$99,700,000	$78,800,000	$100,900,000	$122,100,000	$69,400,000	$86,500,000	$43,100,000	$44,000,000

Lifecycle Costs

Initial Cost	$77,600,000	$99,700,000	$78,800,000	$100,900,000	$122,100,000	$69,400,000	$86,500,000	$43,100,000	$44,000,000
Annual ODC / Fuel / Fixed Costs	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000
Annual Staffing Cost	$108,000	$90,000	$108,000	$90,000	$90,000	$108,000	$90,000	$90,000	$90,000
Slant Well Renewal *	$18,000,000	NA	$18,000,000	NA	NA	$18,000,000	NA	NA	NA
Slant Well Pump Replacement *	$3,000,000	NA	$3,000,000	NA	NA	$3,000,000	NA	NA	NA
Intake Screen Replacement *	NA	$500,000	NA	$500,000	$500,000	NA	$500,000	$500,000	$500,000
NPV @ 4% Interest	$130,800,000	$111,100,000	$132,000,000	$112,300,000	$133,500,000	$122,600,000	$97,900,000	$54,500,000	$55,400,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life
*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

Staff Required for routine O&M (FTE)	0.6	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5

20,000 gpm PS

Engineering Parameters

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	36	36	30	30	30	30	30	30	36	
Intake Tunnel Diameter (inches)	NA	72	NA	72	72	NA	72	72	72	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	50	NA	50	50	NA	50	50	50	
Pump Station/Wellhead Building Size (sf)	1,375	3,100	1,375	3,100	3,100	1,375	3,100	3,100	3,100	Assumed wellhead building dimensions of 55 ft x 25 ft. Assumed spaced min of ~750 ft apart.
Number of Pumps	10	3	10	3	3	10	3	3	3	
Number of Wellhead Bldgs	4	NA	4	NA	NA	4	NA	NA	NA	
Number of Screen Modules	NA	2	NA	2	2	NA	2	2	2	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	10,000	13,000	10,000	13,000	13,000	10,000	13,000	13,000	13,000	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water	notes
Land Purchase	$3,900,000	$5,070,000	$3,900,000	$5,070,000	$5,070,000	$3,900,000	$5,070,000	$8,450,000	$8,450,000	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$7,000,000	$7,500,000	$7,000,000	$7,500,000	$7,500,000	$7,000,000	$7,500,000	$6,500,000	$6,500,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	
Intake Screens	NA	$1,000,000	NA	$1,000,000	$1,000,000	NA	$1,000,000	$1,000,000	$1,000,000	
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$24,000,000	NA	$24,000,000	$18,000,000	NA	$18,000,000	$2,400,000	$2,400,000	Based on updated lengths in row 16
Vertical Excavation	NA	$14,100,000	NA	$14,100,000	$63,800,000	NA	$14,100,000	$9,500,000	$9,500,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$30,000,000	NA	$30,000,000	NA	NA	$30,000,000	NA	NA	NA	
Pumps (equipment)	$5,000,000	$7,800,000	$5,000,000	$7,800,000	$7,800,000	$5,000,000	$7,800,000	$7,800,000	$7,800,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$9,000,000	$17,200,000	$9,000,000	$17,200,000	$17,200,000	$9,000,000	$17,200,000	$17,200,000	$17,200,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$34,000,000	$34,000,000	$39,600,000	$39,600,000	$37,300,000	$23,300,000	$23,300,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$7,000,000	$11,000,000	$11,000,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$7,600,000	$7,600,000	$6,900,000	$6,900,000	$5,200,000	$5,200,000	$5,200,000	$700,000	$800,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$99,400,000	$123,200,000	$104,300,000	$128,100,000	$174,300,000	$96,800,000	$114,600,000	$57,200,000	$58,200,000	

* State Lands Lease, ROW Crossings,
** soft costs included in items above

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Environmental / Permitting / Land Acq.	$11,900,000	$13,570,000	$11,900,000	$13,570,000	$13,570,000	$11,900,000	$13,570,000	$15,950,000	$15,950,000
Pump Station	$45,900,000	$68,000,000	$45,900,000	$68,000,000	$111,200,000	$45,400,000	$61,500,000	$40,100,000	$40,100,000
Piping	$41,600,000	$41,600,000	$46,500,000	$46,500,000	$49,500,000	$39,500,000	$39,500,000	$1,150,000	$2,150,000
TOTAL (rounded up)	$99,400,000	$123,200,000	$104,300,000	$128,100,000	$174,300,000	$96,800,000	$114,600,000	$57,200,000	$58,200,000

Annualized Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Initial Cost	$99,400,000	$123,200,000	$104,300,000	$128,100,000	$174,300,000	$96,800,000	$114,600,000	$57,200,000	$58,200,000
Annual ODC / Fuel / Fixed Costs	$178,000	$178,000	$178,000	$178,000	$178,000	$178,000	$178,000	$178,000	$178,000
Annual Staffing Cost	$144,000	$90,000	$144,000	$90,000	$90,000	$144,000	$90,000	$90,000	$90,000
Slant Well Renewal *	$30,000,000	NA	$30,000,000	NA	NA	$30,000,000	NA	NA	NA
Slant Well Pump Replacement *	$5,000,000	NA	$5,000,000	NA	NA	$5,000,000	NA	NA	NA
Intake Screen Replacement *	NA	$1,000,000	NA	$1,000,000	$1,000,000	NA	$1,000,000	$1,000,000	$1,000,000
NPV @ 4% Interest	$183,600,000	$137,000,000	$188,500,000	$141,900,000	$188,100,000	$181,000,000	$128,400,000	$71,000,000	$72,000,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life
*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Staff Required for routine O&M (FTE)	0.8	0.5	0.8	0.5	0.5	0.8	0.5	0.5	0.5

30,000 gpm PS

Engineering Parameters

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	42	42	36	36	36	36	36	36	36	
Intake Tunnel Diameter (inches)	NA	96	NA	96	96	NA	96	96	96	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	65	NA	65	65	NA	65	65	65	
Pump Station/Wellhead Building Size (sf)	1,375	3,760	1,375	3,760	3,760	1,375	3,760	3,760	3,760	Assumed wellhead building dimensions of 55 ft x 25 ft. Assumed spaced min of ~750 ft apart.
Number of Pumps	13	4	13	4	4	13	4	4	4	
Number of Wellhead Bldgs	5	NA	5	NA	NA	5	NA	NA	NA	
Number of Screen Modules	NA	3	NA	3	3	NA	3	3	3	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	12,500	15,600	12,500	15,600	15,600	12,500	15,600	15,600	15,600	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water	notes
Land Purchase	$4,875,000	$6,084,000	$4,875,000	$6,084,000	$6,084,000	$4,875,000	$6,084,000	$10,140,000	$10,140,000	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$7,500,000	$8,000,000	$7,500,000	$8,000,000	$8,000,000	$7,500,000	$8,000,000	$7,000,000	$7,000,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	
Intake Screens	NA	$1,500,000	NA	$1,500,000	$1,500,000	NA	$1,500,000	$1,500,000	$1,500,000	
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$32,000,000	NA	$32,000,000	$24,000,000	NA	$24,000,000	$3,200,000	$3,200,000	Based on updated lengths in row 16
Vertical Excavation	NA	$23,800,000	NA	$23,800,000	$107,900,000	NA	$23,800,000	$16,000,000	$16,000,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$39,000,000	NA	$39,000,000	NA	NA	$39,000,000	NA	NA	NA	
Pumps (equipment)	$6,500,000	$10,400,000	$6,500,000	$10,400,000	$10,400,000	$6,500,000	$10,400,000	$10,400,000	$10,400,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$11,250,000	$20,800,000	$11,250,000	$20,800,000	$20,800,000	$11,250,000	$20,800,000	$20,800,000	$20,800,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$39,100,000	$39,100,000	$44,000,000	$44,000,000	$41,400,000	$25,900,000	$25,900,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$8,400,000	$13,200,000	$13,200,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$8,800,000	$8,800,000	$7,600,000	$7,600,000	$5,700,000	$5,700,000	$5,700,000	$800,000	$800,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$120,000,000	$155,400,000	$123,700,000	$159,100,000	$238,600,000	$116,400,000	$143,800,000	$73,500,000	$74,400,000	

* State Lands Lease, ROW Crossings,
** soft costs included in items above

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Environmental / Permitting / Land Acq.	$13,375,000	$15,084,000	$13,375,000	$15,084,000	$15,084,000	$13,375,000	$15,084,000	$18,140,000	$18,140,000
Pump Station	$58,650,000	$92,400,000	$58,650,000	$92,400,000	$168,000,000	$58,150,000	$83,900,000	$54,100,000	$54,100,000
Piping	$47,900,000	$47,900,000	$51,600,000	$51,600,000	$55,500,000	$44,800,000	$44,800,000	$1,250,000	$2,150,000
TOTAL (rounded up)	$120,000,000	$155,400,000	$123,700,000	$159,100,000	$238,600,000	$116,400,000	$143,800,000	$73,500,000	$74,400,000

Annualized Costs

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Initial Cost	$120,000,000	$155,400,000	$123,700,000	$159,100,000	$238,600,000	$116,400,000	$143,800,000	$73,500,000	$74,400,000
Annual ODC / Fuel / Fixed Costs	$217,000	$217,000	$217,000	$217,000	$217,000	$217,000	$217,000	$217,000	$217,000
Annual Staffing Cost	$180,000	$90,000	$180,000	$90,000	$90,000	$180,000	$90,000	$90,000	$90,000
Slant Well Renewal *	$39,000,000	NA	$39,000,000	NA	NA	$39,000,000	NA	NA	NA
Slant Well Pump Replacement *	$6,500,000	NA	$6,500,000	NA	NA	$6,500,000	NA	NA	NA
Intake Screen Replacement *	NA	$1,500,000	NA	$1,500,000	$1,500,000	NA	$1,500,000	$1,500,000	$1,500,000
NPV @ 4% Interest	$228,500,000	$172,000,000	$232,200,000	$175,700,000	$255,200,000	$224,900,000	$160,400,000	$90,100,000	$91,000,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life
*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

	SD Slant Wells	SD Open Water	RAS Slant Wells	RAS Open Water (Ocean Beach)	RAS Open Water (Bluffs)	RAN Slant Wells	RAN Open Water	North Bayfront Open Water	East Bayfront Open Water
Staff Required for routine O&M (FTE)	0.9	0.5	0.9	0.5	0.5	0.9	0.5	0.5	0.5

40,000 gpm PS

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Engineering Parameters										
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	48	48	42	42	42	42	42	42	42	
Intake Tunnel Diameter (inches)	NA	108	NA	108	108	NA	108	108	108	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	80	NA	80	80	NA	80	80	80	
Pump Station/Wellhead Building Size (sf)	1,375	4,418	1,375	4,418	4,418	1,375	4,418	4,418	4,418	Assumed wellhead building dimensions of 55 ft x 25 ft. Assumed spaced min of ~750 ft apart.
Number of Pumps	17	5	17	5	5	17	5	5	5	
Number of Wellhead Bldgs	6	NA	6	NA	NA	6	NA	NA	NA	
Number of Screen Modules	NA	4	NA	4	4	NA	4	4	4	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	15,000	18,720	15,000	18,720	18,720	15,000	18,720	18,720	18,720	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations
Initial Costs										
Land Purchase	$5,850,000	$7,300,800	$5,850,000	$7,300,800	$7,300,800	$5,850,000	$7,300,800	$12,168,000	$12,168,000	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$8,000,000	$8,500,000	$8,000,000	$8,500,000	$8,500,000	$8,000,000	$8,500,000	$7,500,000	$7,500,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	
Intake Screens	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$36,000,000	NA	$36,000,000	$27,000,000	NA	$27,000,000	$3,600,000	$3,600,000	Based on updated lengths in row 16
Vertical Excavation	NA	$36,000,000	NA	$36,000,000	$163,300,000	NA	$36,000,000	$24,300,000	$24,300,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$51,000,000	NA	$51,000,000	NA	NA	$51,000,000	NA	NA	NA	
Pumps (equipment)	$8,500,000	$13,000,000	$8,500,000	$13,000,000	$13,000,000	$8,500,000	$13,000,000	$13,000,000	$13,000,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$13,500,000	$24,500,000	$13,500,000	$24,500,000	$24,500,000	$13,500,000	$24,500,000	$24,500,000	$24,500,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$45,900,000	$45,900,000	$50,600,000	$50,600,000	$47,600,000	$29,800,000	$29,800,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$9,800,000	$15,400,000	$15,400,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$10,300,000	$10,300,000	$8,800,000	$8,800,000	$6,600,000	$6,600,000	$6,600,000	$900,000	$900,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$146,000,000	$188,500,000	$149,200,000	$191,700,000	$314,100,000	$141,100,000	$174,600,000	$91,700,000	$92,600,000	

* State Lands Lease, ROW Crossings,
** soft costs included in items above

	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Environmental / Permitting / Land Acq.	$14,850,000	$16,800,800	$14,850,000	$16,800,800	$16,800,800	$14,850,000	$16,800,800	$20,668,000	$20,668,000
Pump Station	$74,900,000	$115,400,000	$74,900,000	$115,400,000	$233,200,000	$74,400,000	$105,900,000	$69,600,000	$69,600,000
Piping	$56,200,000	$56,200,000	$59,400,000	$59,400,000	$64,000,000	$51,800,000	$51,800,000	$1,350,000	$2,250,000
TOTAL (rounded up)	$146,000,000	$188,500,000	$149,200,000	$191,700,000	$314,100,000	$141,100,000	$174,600,000	$91,700,000	$92,600,000

Annualized Costs

	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Initial Cost	$146,000,000	$188,500,000	$149,200,000	$191,700,000	$314,100,000	$141,100,000	$174,600,000	$91,700,000	$92,600,000
Annual ODC / Fuel / Fixed Costs	$263,000	$263,000	$263,000	$263,000	$263,000	$263,000	$263,000	$263,000	$263,000
Annual Staffing Cost	$216,000	$180,000	$216,000	$180,000	$180,000	$216,000	$180,000	$180,000	$180,000
Slant Well Renewal *	$51,000,000	NA	$51,000,000	NA	NA	$51,000,000	NA	NA	NA
Slant Well Pump Replacement *	$8,500,000	NA	$8,500,000	NA	NA	$8,500,000	NA	NA	NA
Intake Screen Replacement *	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000
NPV @ 4% Interest	$286,100,000	$212,000,000	$289,300,000	$215,200,000	$337,600,000	$281,200,000	$198,100,000	$115,200,000	$116,100,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life
*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing

	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Staff Required for routine O&M (FTE)	1.1	0.9	1.1	0.9	0.9	1.1	0.9	0.9	0.9

50,000 gpm PS

	Ocean Side							Bay Side		
	Southern Dunes		Rocky Area South			Rocky Area North		North Bayfront	East Bayfront	notes
Intake Type:	Slant Wells	Open Water	Slant Wells	Open Water (Ocean Beach)	Open Water (Bluffs)	Slant Wells	Open Water	Open Water	Open Water	
Engineering Parameters										
Distance to Nearest EFWS Piping (miles)	1.7	1.7	2.2	2.2	2.2	1.5	1.5	0.05	0.15	
Distance for microtunneling of Disch. Piping (ft)	NA	NA	NA	NA	700	1,100	1,100	NA	NA	est from Google Earth
Discharge Piping Diameter (inches)	54	54	48	48	48	48	48	48	48	
Intake Tunnel Diameter (inches)	NA	120	NA	120	120	NA	120	120	120	
Vertical Excavation Depth (ft)	NA	46	NA	46	209	NA	46	31	31	Depth from ground surface to invert of intake tunnel assuming 10 ft cover below MSL
Vertical Excavation Diameter (ft)	NA	95	NA	95	95	NA	95	95	95	
Pump Station/Wellhead Building Size (sf)	1,375	5,076	1,375	5,076	5,076	1,375	5,076	5,076	5,076	Assumed wellhead building dimensions of 55 ft x 25 ft. Assumed spaced min of ~750 ft apart.
Number of Pumps	20	6	20	6	6	20	6	6	6	
Number of Wellhead Bldgs	7	NA	7	NA	NA	7	NA	NA	NA	
Number of Screen Modules	NA	5	NA	5	5	NA	5	5	5	Assume ISI T42-66 tee screen, approx 10,000 gpm / screen w/ < 0.5 fps slot velocity
Land Area Required (sf)	17,500	22,464	17,500	22,464	22,464	17,500	22,464	22,464	22,464	
Length of Intake Piping (ft)	NA	2,000	NA	2,000	1,500	NA	1,500	200	200	Pushed intake piping out farther into ocean beyond surf zone
Length of Recirculation/Test Piping (ft)	2,000	2,000	2,000	2,000	1,500	1,500	1,500	200	200	Same length as intake piping
Volume Dredged (cy)	93,000	93,000	93,000	93,000	69,000	69,000	69,000	9,000	9,000	Added dredging for recirculation/test piping at slant well locations

Initial Costs	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water	notes
Land Purchase	$6,825,000	$8,760,960	$6,825,000	$8,760,960	$8,760,960	$6,825,000	$8,760,960	$14,601,600	$14,601,600	based on land area req'd & unit rate
Easements / Leases*	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	plug estimate (e.g. State Lands Commission, CALTRANS, etc.)
NEPA / CEQA / Permitting	$8,500,000	$9,000,000	$8,500,000	$9,000,000	$9,000,000	$8,500,000	$9,000,000	$8,000,000	$8,000,000	based upon review disc. w/ Scott MacPherson of PUC BEM
Open Water Intake (concrete box)	NA	$2,000,000	NA	$2,000,000	$2,000,000	NA	$2,000,000	$2,000,000	$2,000,000	
Intake Screens	NA	$2,500,000	NA	$2,500,000	$2,500,000	NA	$2,500,000	$2,500,000	$2,500,000	
Dredging	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,400,000	$1,400,000	$1,400,000	$200,000	$200,000	Added dredging costs for recirculation/test piping at slant well locations
Intake Tunnel	NA	$40,000,000	NA	$40,000,000	$30,000,000	NA	$30,000,000	$4,000,000	$4,000,000	Based on updated lengths in row 16
Vertical Excavation	NA	$50,700,000	NA	$50,700,000	$230,300,000	NA	$50,700,000	$34,200,000	$34,200,000	See estimated depths in row 11.
Slant Well Drilling / Development / Setup	$60,000,000	NA	$60,000,000	NA	NA	$60,000,000	NA	NA	NA	
Pumps (equipment)	$10,000,000	$15,600,000	$10,000,000	$15,600,000	$15,600,000	$10,000,000	$15,600,000	$15,600,000	$15,600,000	Assume $X / pump, each @ 10,000 gpm (for Open Water), $500k/pump (for slant wells)
Pump Station/Wellhead Buildings	$15,750,000	$28,100,000	$15,750,000	$28,100,000	$28,100,000	$15,750,000	$28,100,000	$28,100,000	$28,100,000	Includes common wellhead enclosure costs. Open water PS cost includes PRV in vault for recirculation/test piping ($270k).
Discharge Piping (to connect w/ EFWS) (base cost, assuming cut & cover)	$52,700,000	$52,700,000	$59,400,000	$59,400,000	$55,900,000	$34,900,000	$34,900,000	$450,000	$1,350,000	Assume $15M / mi for 24" dia Kubota; scale down/up accordingly
Microtunneling / etc. for disch. Piping	NA	NA	NA	NA	$11,200,000	$17,600,000	$17,600,000	NA	NA	(use unit rates in O36/37, upsize/downsize based on diameter
Recirculation/Test Piping (return to ocean/bay)	$11,800,000	$11,800,000	$10,300,000	$10,300,000	$7,700,000	$7,700,000	$7,700,000	$1,100,000	$1,100,000	Assume same diam as disch. piping and same length as intake tunnel/piping, @ $xxxx/mile, with PRV @ PS
Up-Sizing Existing EFWS Piping	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Costs cannot be determined at this point; will depend on location(s) and capacities selected based on hyd. Modeling
TOTAL	$168,500,000	$224,100,000	$173,700,000	$229,300,000	$403,500,000	$163,700,000	$209,300,000	$111,800,000	$112,700,000	

* State Lands Lease, ROW Crossings,
** soft costs included in items above

	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Environmental / Permitting / Land Acq.	$16,325,000	$18,760,960	$16,325,000	$18,760,960	$18,760,960	$16,325,000	$18,760,960	$23,601,600	$23,601,600
Pump Station	$87,650,000	$140,800,000	$87,650,000	$140,800,000	$309,900,000	$87,150,000	$130,300,000	$86,600,000	$86,600,000
Piping	$64,500,000	$64,500,000	$69,700,000	$69,700,000	$74,800,000	$60,200,000	$60,200,000	$1,550,000	$2,450,000
TOTAL (rounded up)	$168,500,000	$224,100,000	$173,700,000	$229,300,000	$403,500,000	$163,700,000	$209,300,000	$111,800,000	$112,700,000

Annualized Costs	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Initial Cost	$168,500,000	$224,100,000	$173,700,000	$229,300,000	$403,500,000	$163,700,000	$209,300,000	$111,800,000	$112,700,000
Annual ODC / Fuel / Fixed Costs	$317,000	$317,000	$317,000	$317,000	$317,000	$317,000	$317,000	$317,000	$317,000
Annual Staffing Cost	$252,000	$180,000	$252,000	$180,000	$180,000	$252,000	$180,000	$180,000	$180,000
Slant Well Renewal *	$60,000,000	NA	$60,000,000	NA	NA	$60,000,000	NA	NA	NA
Slant Well Pump Replacement *	$10,000,000	NA	$10,000,000	NA	NA	$10,000,000	NA	NA	NA
Intake Screen Replacement *	NA	$2,500,000	NA	$2,500,000	$2,500,000	NA	$2,500,000	$2,500,000	$2,500,000
NPV @ 4% Interest	$333,600,000	$251,000,000	$338,800,000	$256,200,000	$430,400,000	$328,800,000	$236,200,000	$138,700,000	$139,600,000

*for open water option, assume screen will be replaced every 15 years, the PS has a total of 45 year life
*for slant well option, assume each slant well and pump will be replaced every 15 years

Staffing	Southern Dunes Slant Wells	Southern Dunes Open Water	Rocky Area South Slant Wells	Rocky Area South Open Water (Ocean Beach)	Rocky Area South Open Water (Bluffs)	Rocky Area North Slant Wells	Rocky Area North Open Water	North Bayfront Open Water	East Bayfront Open Water
Staff Required for routine O&M (FTE)	1.3	0.9	1.3	0.9	0.9	1.3	0.9	0.9	0.9

Unit Cost Table

Discharging piping cost		
Size	Unit Cost per mile	cost per mile including all soft cost
12	$8,000,000	
14	$9,000,000	
16	$10,000,000	
18	$12,000,000	
20	$14,000,000	
24	$15,000,000	
30	$18,000,000	
36	$20,000,000	
42	$23,000,000	
48	$27,000,000	
54	$31,000,000	

Dredging (Bay Side Only)		
Unit rate:	$20	$/CY
W	50	ft
D	25	ft
	1	cy
	27	cft

Microtunneling / Jack-Bore (72" and below)		
Size	unit cost per LF	
20	$7,000.00	$ / lf
24	$8,000	$ / lf
30	$10,000	$ / lf
36	$12,000	$ / lf
42	$14,000	$ / lf
48	$16,000	$ / lf
54	$18,000	$ / lf

Bigtunneling (96" and above)		
Size	unit cost per LF	
60	$10,000	$ / lf
72	$12,000	$ / lf
96	$16,000	$ / lf
108	$18,000	$ / lf
120	$20,000	$ / lf

Access Shaft / Caissons

2 pumps = 35 ft, 3 pumps = 50 ft, 4 pumps = 65 ft, 5 pumps = 80 ft, 6 pumps = 95 ft

shaft only	$20,000,000	40 ft dia @ 150 ft deep:
	10%	equipment
	10%	mobilization
	10%	safety
(all - in)	$29,300,000	40 ft dia @ 150 ft deep:
	188496	cu ft in volumn
	$155	$ / cubic ft

Slant Wells

Wellhead Array Enclosure (ea)	$2,250,000	assume 3,3,2,2 configuration for 10 wells; 4 primary structures + 1 standy structure per location; cost includes emergency generator and PRV vault	Generator: 1.5 MW @ $1M; Building @ $1.25M inc. PRV & Vault)
	$3,000,000	Slant Well Drilling/Development/Testing (ea)	
	$500,000	Slant Well Pumps (ea), 3,000 gpm capacity	

Land Area Required

Capacity GPM	Slant Wells sqft	Open Water sqft	
3,000	2,500	3,700	-20%
6,000	2,500	3,700	-20%
10,000	7,500	10,400	-20%
20,000	10,000	13,000	
30,000	12,500	15,600	20%
40,000	15,000	18,720	20%
50,000	17,500	22,464	20%

Land Purchase

$390	$ unit cost per sqft for the southern dunes and rocky side	added 30% contingency, per D. Brasil, 4/15/21
$650	$ unit cost per sqft for the bayside	added 30% contingency, per D. Brasil, 4/15/21

Pumps

$2,600,000	unit cost per 10,000 gpm open water pump
$780,000	unit cost for 3,000 gpm open water pump
$1,560,000	unit cost for 6,000 gpm open water pump
2.6	multiplier to include all design and soft cost, calculated from sunset cost ($11M subtotal to $28M total cost)

GPM	PS and Bldg cost		
3,000			
6,000			
10,000			
20,000			
30,000	$20,800,000	estiamted from sunset, including soft and other cost	$5,532
40,000			
50,000			

Intake

Qty 1	$2,000,000	screened intake cost, assumed (concrete)

Screens for flows of:

10,000	$500,000	Assumed cost of screen, installed
20,000	$1,000,000	
30000	$1,500,000	
40000	$2,000,000	
50000	$2,500,000	

Emergency Firefighting Water System Update

John Scarpulla, SFPUC

What is the EFWS?

- Emergency Firefighting Water System (EFWS): A high pressure fire-suppression water system built after 1906 earthquake.
- Hetch Hetchy Regional Water System = Primary Source of Water
- EFWS ownership transferred to SFPUC in 2010
- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works
- Hydraulic modeling utilized to guide decision making.

San Francisco Water Power Sewer

ONESF Building Our Future

Partnership

- Evaluation of EFWS when transferred to SFPUC:
  - Using modern seismic resilience capability analysis looking for vulnerabilities, leading to immediate and future projects
  - 47% system reliability for median flow of water needed by SFFD to fight fires after 7.8 earthquake
- Since 2010 - SFPUC, SFFD, and Public Works have been implementing projects to improve the EFWS.
- Projects completed utilizing Earthquake Safety and Emergency Response Bonds:
  - 2010 Bond: $102 million for EFWS capital projects
  - 2014 Bond: $54 million for EFWS capital projects
  - 2020 Bond: $153.5 million for EFWS capital projects

Today's Topics – Updates on Reports

- *By June 30, 2021, continue and complete the more detailed analysis of emergency firefighting water needs by neighborhood.*

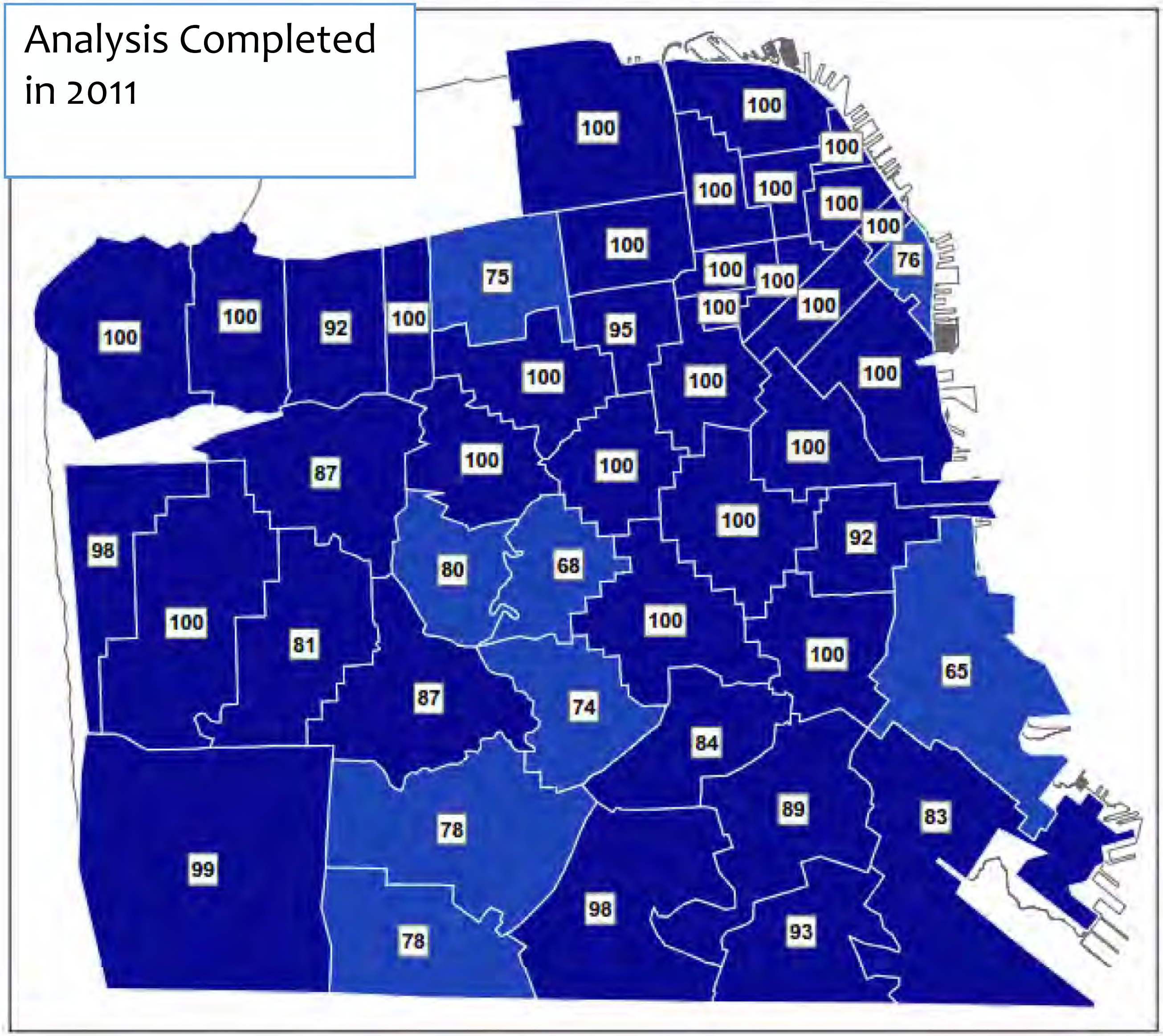
- *By June 30, 2021, complete a study analyzing additional EFWS seawater pump stations.*

San Francisco Water Power Sewer

ONESF Building Our Future

Refine Neighborhood Analysis

Analysis Completed in 2011



ONESF Building Our Future

Neighborhood Firefighting Needs

- Refine earthquake ***firefighting water needs.*** *Update and "Zoom in".*
- Based on:
  - Seismological, geotechnical, building inventory (materials, density, sprinkler systems, etc.), vegetation, SFFD resources and other data
  - City buildings: current and future growth
  - EFWS
    – current and extended
- Current and for 2030, 2040, 2050

San Francisco Water Power Sewer

ONESF Building Our Future

Project background

- Key step in upgrading EFWS
- Update to previous work
- Began in 2018
- Civil Grand Jury report

Project team

SFPUC

- David Myerson, P.E
- Ada Zhu, P.E.
- Leroy Gullette, P.E.

SFFD

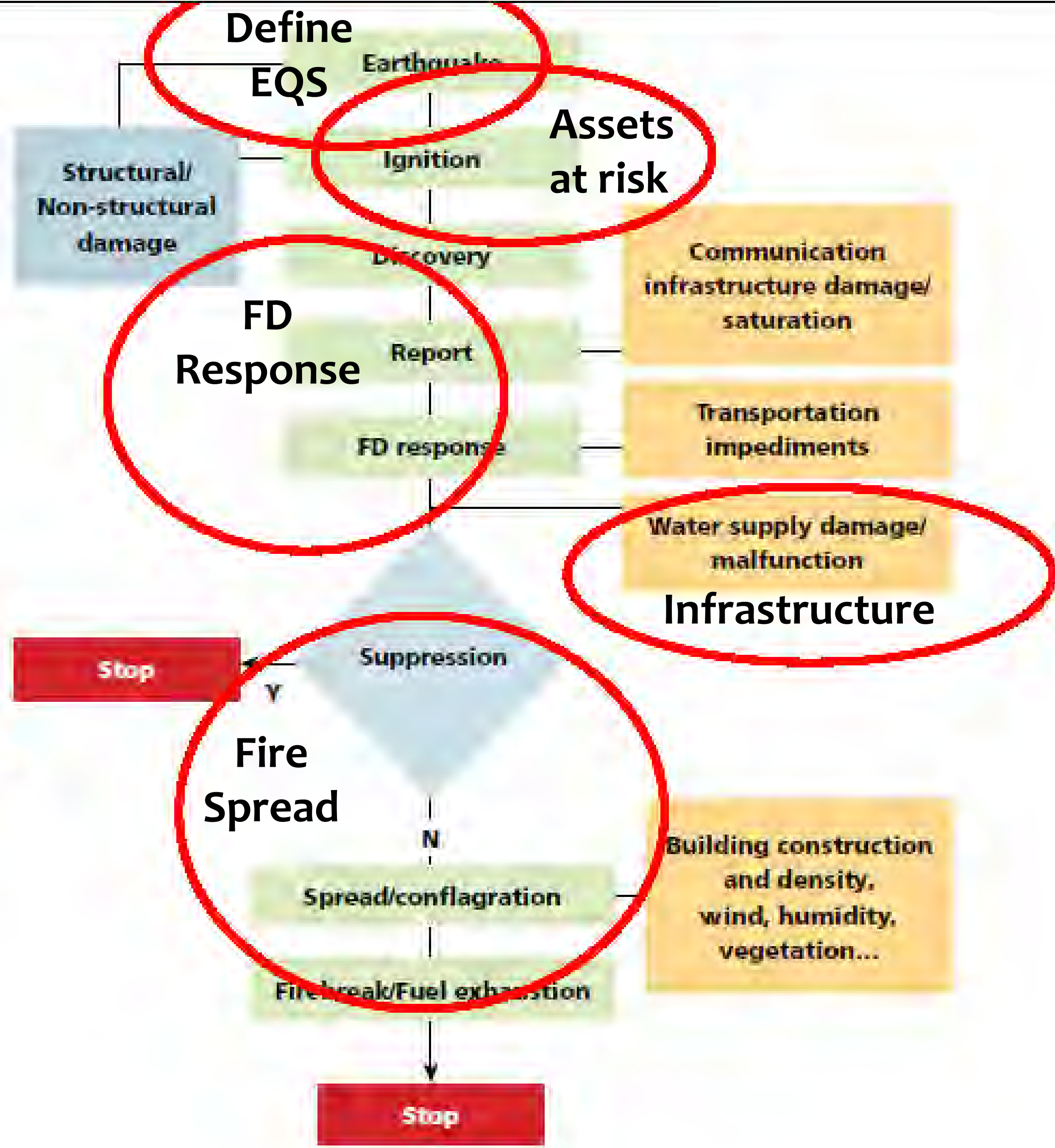
- Chief Dawn Dewitt
- Capt. Brent Stuckert

AECOM

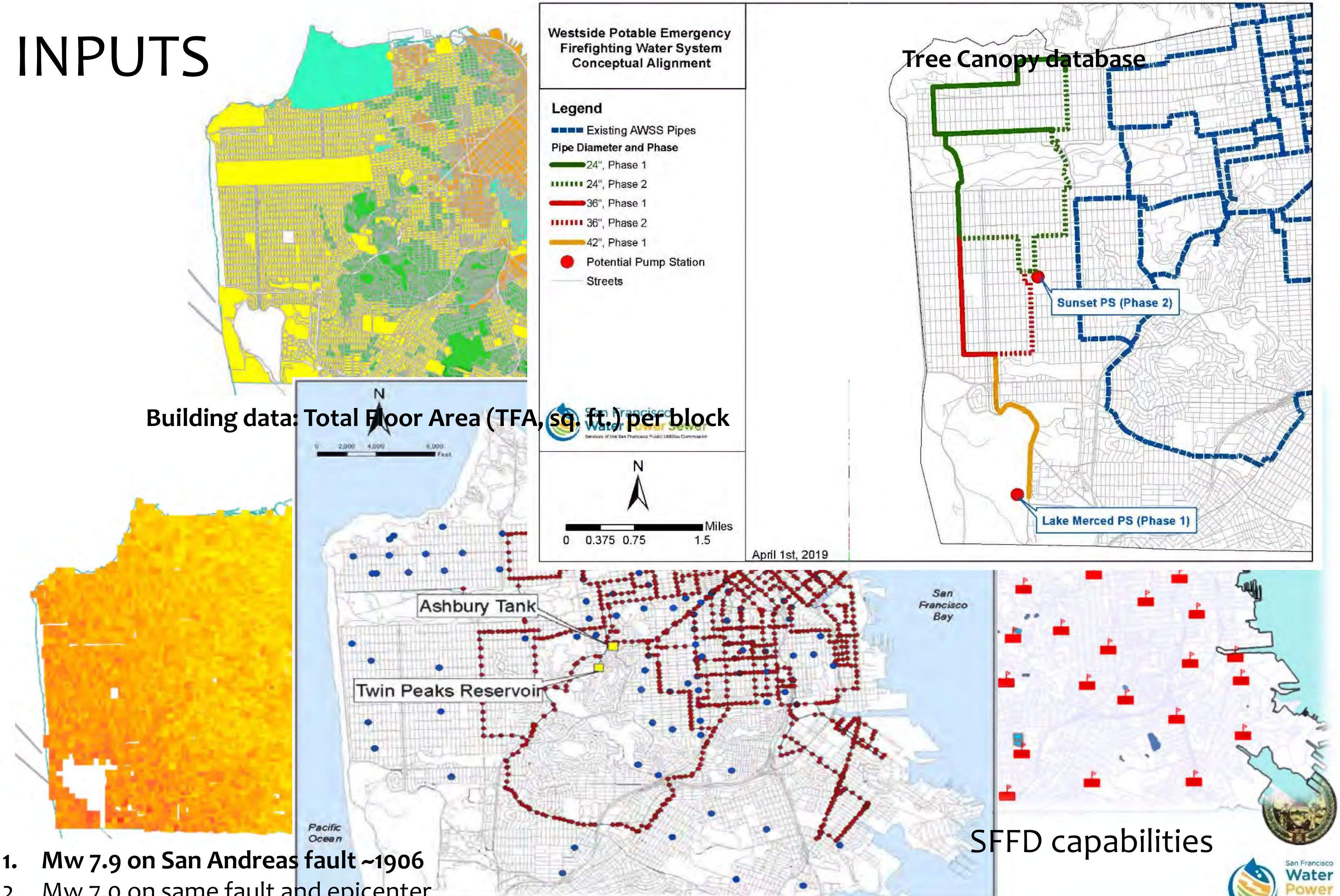
- Craig Smith, P.E.
- Derrick Wong, P.E.

SPA Risk:

- Prof. Charles Scawthorn, S.E.


Define
EQS
Earthquake
Assets
at risk
Structural/
Non-structural
damage
Ignition
Discovery
Communication
infrastructure damage/
saturation
FD
Response
Report
FD response
Transportation
impediments
Water supply damage/
malfunction
Infrastructure
Stop
Y
Suppression
Fire
Spread
N
Building construction
and density,
wind, humidity,
vegetation...
Spread/conflagration
Firebreak/Fuel exhaustion
Stop

INPUTS

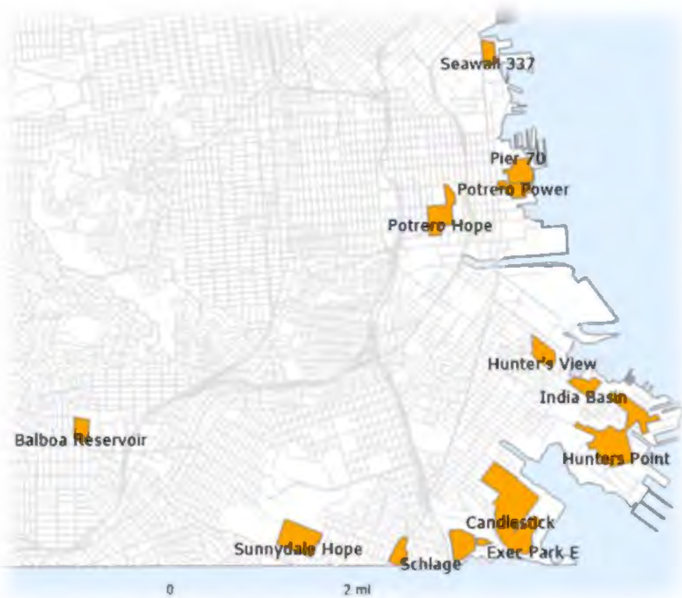


1. **Mw 7.9 on San Andreas fault ~1906**
2. Mw 7.0 on same fault and epicenter
3. Mw. 7.05 on Hayward fault

San Francisco Water Power Sewer

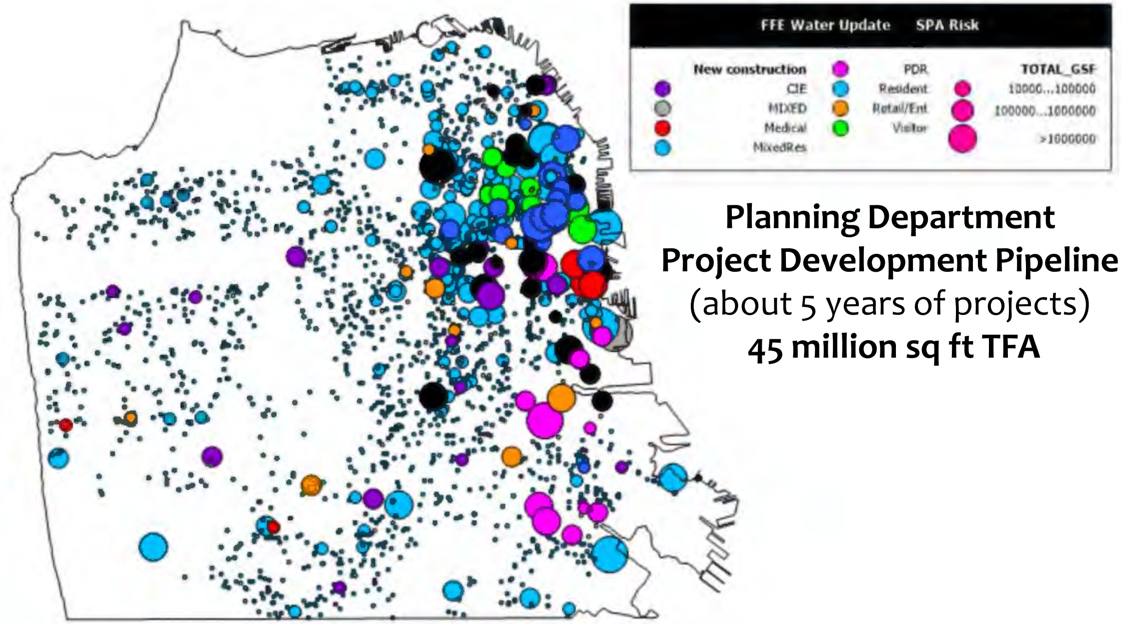
ONESF Building Our Future

Analysis for 2020, 2030, 2040, and 2050



- 12 Projects 2020-2035
- 60 million sq ft floor area (7% entire city)
- $17 billion construction

Data Source: San Francisco Planning Department



Planning Department Project Development Pipeline
(about 5 years of projects)
45 million sq ft TFA

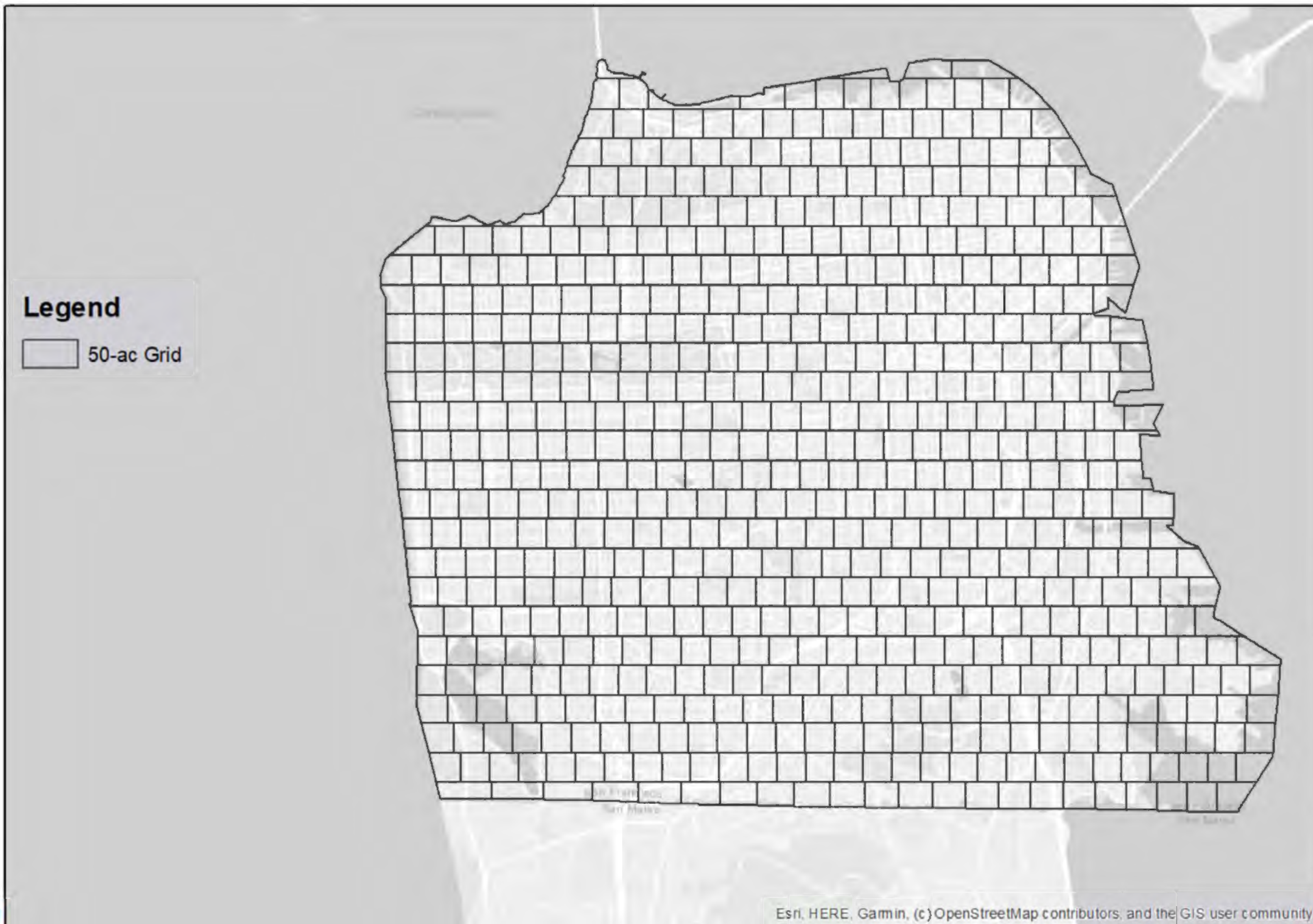
Best estimates – some uncertainty

Year	2020	2030	2040	2050
Population	883,000	960,000	1,035,000	1,112,000
Bldg GSF (mills)	877	970	1,071	1,184
GSF growth	0%	11%	22%	35%

San Francisco Water Power Sewer

ONESF Building Our Future

Future Deliverables: 2020-2050 Maps



San Francisco Water Power Sewer

Next Steps: Neighborhood Fire Analysis

- Continue to refine inputs for model simulations for 2020, 2030, 2040, and 2050.
- Complete maps for 2020, 2030, 2040, and 2050.
- Use the analysis to inform the development of the comprehensive, citywide EFWS action plan (due to Board: 12/31/2021)

Seawater Pumpstation Report

High-level Evaluation:

- Regulatory / Permitting
- Siting Considerations
- Geotechnical and Geological
- Sea Level Rise
- Engineering
- Intake Types
- Capital Cost
- Operations & Maintenance
- Operating Costs

Regulatory & Permitting

Primary Shoreline Regulatory Jurisdictions

- **Ocean side:** California Coastal Commission (CCC) & National Park Service (NPS)
- **Bay side:** SF Bay Conservation and Development Commission (BCDC) & NPS

Secondary Shoreline Regulatory Jurisdictions

- **Ocean side:** State Lands Commission; State Water Resources Control Board; Regional Water Quality Control Board; US Army Corps of Engineers; National Marine Fisheries Service (NMFS); California Department of Fish and Wildlife (CDFW); U.S. Coast Guard (USCG)
- **Bay side:** All of the above, plus Port of San Francisco

City Interior Potentially Affected Regulatory Jurisdictions

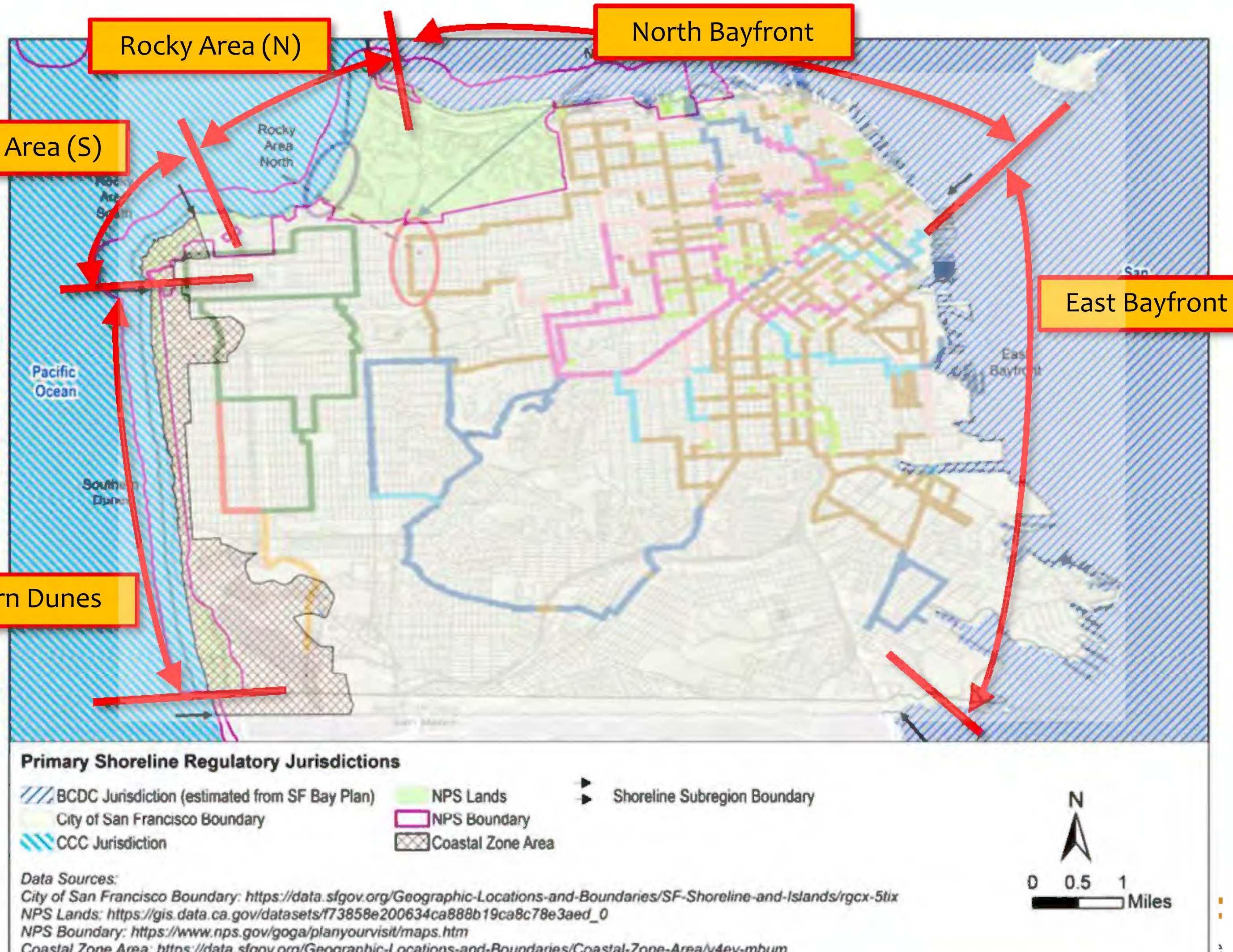
- City Planning Department; California Department of Transportation (Caltrans); Regional Transit Agencies; Region 2 Water Quality Control Board; Presidio Trust; CDFW; U. S. Fish and Wildlife Service (UFWS); California State Parks (East Bayfront); and Bay Area Air Quality Management District (BAAQMD)

ONESF Building Our Future

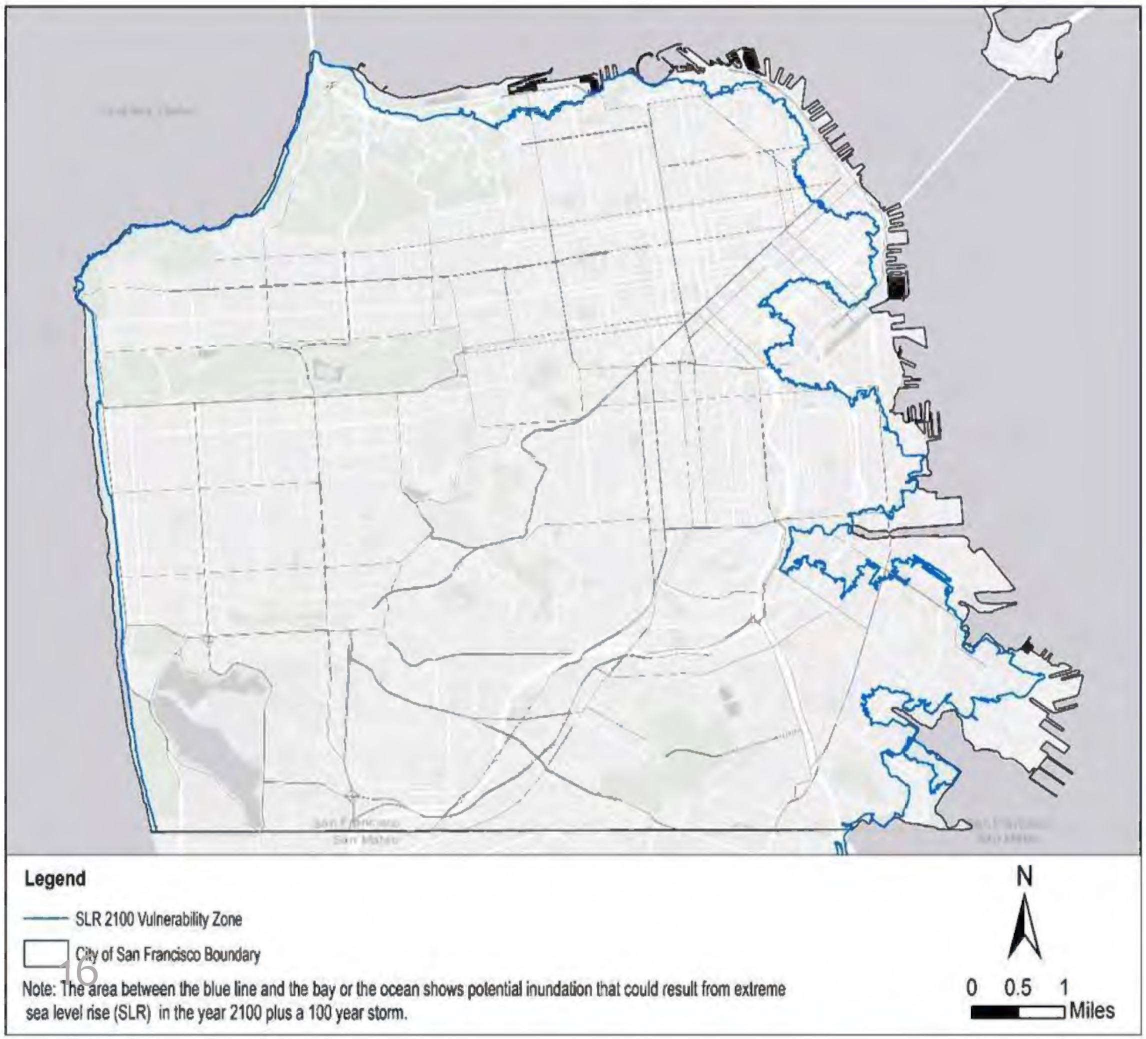
Areas of Study

<u>Ocean Side</u>
Southern Dunes
Rocky Area (south)
Rocky Area (north)

<u>Bay Side</u>
North Bayfront
East Bayfront



Sea level Rise & Inundation Zones



MITIGATION MEASURES:

Hazard Avoidance

Inland or at higher elevation

Protection

Site Modifications

Raising grade

Elevating sensitive components

Flood-proofing structures

Geological and Geotechnical

Figure 7-7: Geologic Map of San Francisco

Elevations Analysis

Figure 5-3: Typical Cross Section – Sloat Boulevard

Figure 5-15: Typical Cross Section – Hunters Point Area

Figure 5-7: Typical Cross Section – Lands End Area

Figure 5-14: Typical Cross Section – 23rd Street/Potrero Power Station Area

San Francisco Water Power Sewer

ONESF Building Our Future

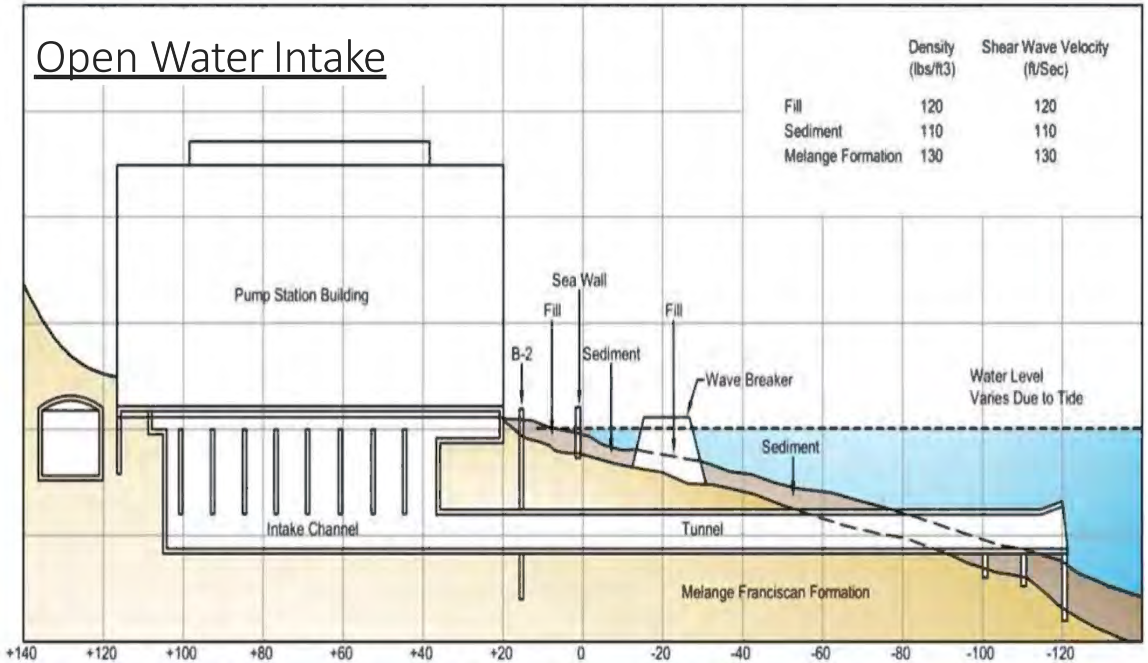
Engineering Factors to Consider

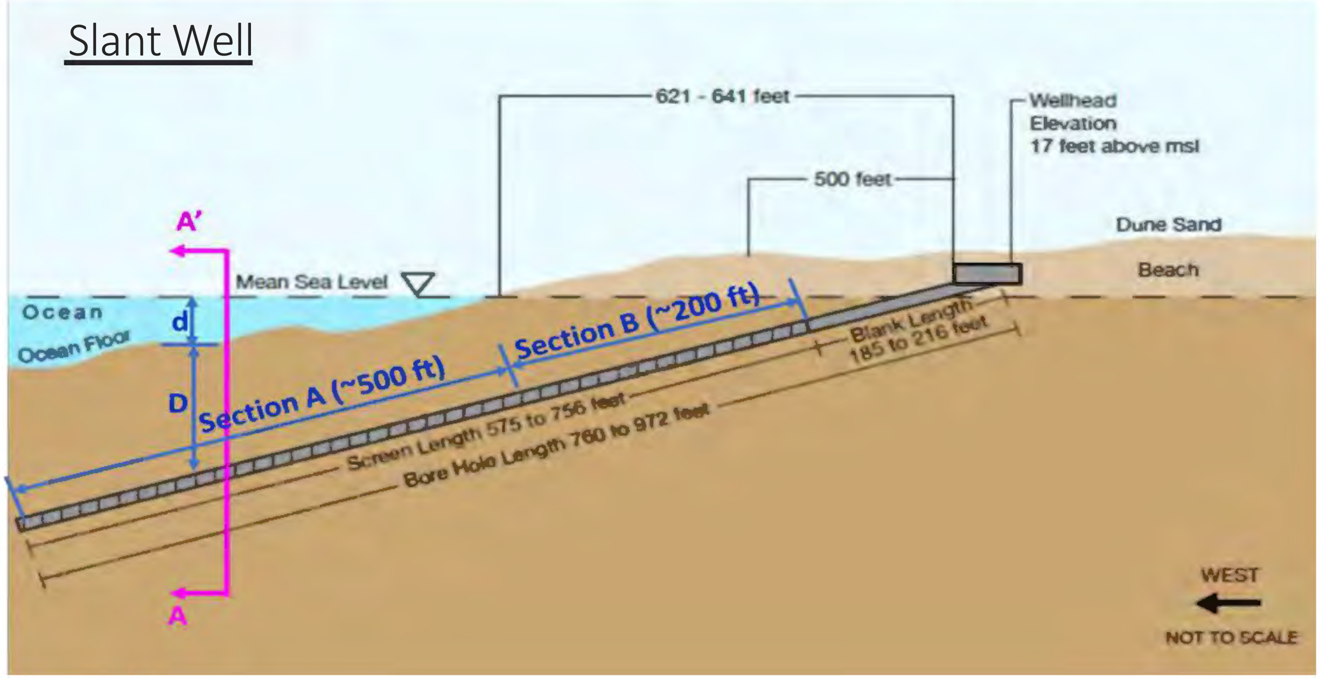
- Distance from the shoreline to the closest tie-in point of the EFWS and the elevation differences between these locations.
- Use pipeline lengths and elevations to understand pipe diameters and pump discharge pressures needed for flows ranging from 10,000 to 50,000 gpm.
- The sizes of new piping to connect new seawater intakes to the existing EFWS for flows in the 10,000 to 50,000 gpm range may require "up-sizing" (increasing the diameter) of existing EFWS piping in certain areas

San Francisco Water Power Sewer

ONESF Building Our Future

Pump Station Type





Next Steps – Seawater Report

- Continue engineering and analysis, including assessment of flow requirements, refinement of engineering aspects, and environmental / permitting requirements.

- Develop capital and operations and maintenance costs for a wide variety of options.

- Use the analysis to inform the development of the comprehensive, citywide EFWS action plan (due to Board: 12/31/2021)

San Francisco Water Power Sewer

ONESF Building Our Future

Next Steps - Programmatic

- Complete two reports (Seawater and Neighborhood demands) and submit to the Board by June 30, 2021.

- By December 31, 2021, develop and submit a comprehensive, citywide EFWS action plan.

- Present at the Board in July 2021 and January 2022

Questions?

San Francisco Water Power Sewer

ONESF Building Our Future

EMERGENCY FIREFIGHTING WATER SYSTEM

Budget and Legislative Analyst's Report

GAO Committee – January 21, 2021

WESTSIDE PHASE I PROJECT

- Funding is in place for Westside Phase I: approximately $198 million
  - $ 143 million from 2020 ESER Bonds
  - $55 million from Water Enterprise revenue bonds
- 2020 ESER Bond: $628.5 million
  - Issuance, sale, and appropriation of $85 million before Board of Supervisors
  - Initial $20 million for planning, design, and CEQA review of EFWS projects
- Potable water system allows for Water Enterprise revenues

HOSE TENDERS

- Each truck consists of 1 mile of hose, a portable pump, portable hydrants, and other firefighting equipment. The cost is approximately $1 million
- OCA is currently in the process of purchasing 3 hose tenders
  - FY 2019-20 budget included $4 million to purchase 4 new hose tenders
  - California OES provided $1 million for additional hose tender
  - Mayor's Budget Office cut $2 million as part of mid-year rebalancing plan, leaving $3 million in budget for 3 hose tenders
- Potential for lease revenue financing for hose tender purchases
  - OPF can authorize $85 million under SF Finance Corporation
  - Has been used for fire equipment in the past

FUTURE ESER BONDS

- $217 million ESER Bond is planned for the 2027 ballot
  - Amount dedicated to EFWS is not currently known
  - ESER Bond would also be used to fund other projects
- 2027 ESER Bond may impact feasibility of stand-alone ESER bond for EFWS

QUESTIONS?

- We are available for questions
- Thank you for your time

File No. 190785 **Committee Item No.** 1
Board Item No. ____

COMMITTEE/BOARD OF SUPERVISORS

AGENDA PACKET CONTENTS LIST

Committee: Government Audit and Oversight **Date:** January 21, 2021
Board of Supervisors Meeting: **Date:** ____

Cmte	Board	
☐	☐	**Motion**
☐	☐	**Resolution**
☐	☐	**Ordinance**
☐	☐	**Legislative Digest**
☐	☐	**Budget and Legislative Analyst Report**
☐	☐	**Youth Commission Report**
☒	☐	**Introduction Form**
☐	☐	**Department/Agency Cover Letter and/or Report**
☐	☐	**MOU**
☐	☐	**Grant Information Form**
☐	☐	**Grant Budget**
☐	☐	**Subcontract Budget**
☐	☐	**Contract/Agreement**
☐	☐	**Form 126 – Ethics Commission**
☐	☐	**Award Letter**
☐	☐	**Application**
☒	☐	**Public Correspondence**

OTHER

☒	☐	BLA Report – December 2, 2020
☒	☐	SFPUC EFWS Presentation – July 16, 2020
☒	☐	SFPUC Report – June 25, 2020
☒	☐	Reso. No. 484-19
☒	☐	COB Letter – Transmitting Reso. No 422-19 – October 15, 2020
☒	☐	SFPUC Presentation – September 19, 2019
☒	☐	Mayor Consolidated Response - September 16, 2019
☒	☐	SFPUC Response – September 11, 2019
☒	☐	Fire Commission Response – September 12, 2019
☒	☐	Civil Grand Jury Report – July 17, 2019
☒	☐	COB Letter – July 24, 2019
☒	☐	Response Matrices
☒	☐	Transmittal Letters

Prepared by: John Carroll **Date:** January 15, 2021
Prepared by: John Carroll **Date:** ____

CITY AND COUNTY OF SAN FRANCISCO
BOARD OF SUPERVISORS
BUDGET AND LEGISLATIVE ANALYST
1390 Market Street, Suite 1150, San Francisco, CA 94102
(415) 552-9292 FAX (415) 252-0461

Policy Analysis Report

To: Supervisor Mar
From: Budget and Legislative Analyst's Office
Re: Status of Emergency Firefighting Water System Analysis
Date: December 2, 2020

Summary of Requested Action

Your office requested that the Budget and Legislative Analyst study the Emergency Firefighting Water System (EFWS) through an equity lens that includes analysis of what is needed in the western and southern neighborhoods to provide them with fire protection equal to the protection level currently covering the eastern and central areas of the City that are safeguarded by an independent EFWS and by access to unlimited saltwater through two 10,000 gallon per minute pumps; and issue a report to the Board no later than December 31, 2020 on (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and long term that include acquisition of the high priority hose tender equipment, suggestions for multiple funding sources to finance the equitable citywide fire protection, and a proposed timeline for project completion.

For further information about this report, contact Severin Campbell at the Budget and Legislative Analyst's Office.

Executive Summary

- The City is at risk for major fires following an earthquake. According to a 2014 study by the United States Geological Survey (USGS), San Francisco has a 72 percent chance of a magnitude 6.7 or larger earthquake (equivalent to the 1989 Loma Prieta earthquake) prior to 2043. According to a 1992 report to the National Science Foundation, the 1989 Loma Prieta earthquake caused 41 fires in San Francisco, largely due to electrical wiring and electric and gas appliances.
- The City's Emergency Firefighting Water System (EFWS) does not sufficiently cover all areas of the City, placing some neighborhoods at higher risk for fires after an earthquake. According to an analysis by the San Francisco Public Utilities Commission (SFPUC), 15 of 48 Fire Response Areas (FRAs) have reliability scores below 50 percent. This means that after a 7.8-magnitude earthquake these FRAs would have less than half the water supply necessary to meet the median firefighting demands. The western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited EFWS coverage, and generally have FRA scores of less than 50 percent.

- SFPUC has developed a plan to construct a potable EFWS system in the Sunset and Richmond Districts (EFWS Westside). The estimated cost of the EFWS Westside Phase I project is approximately $198 million, of which funding from the 2020 Earthquake Safety and Emergency Response (ESER) Bond and Water Enterprise revenues is available. This project is expected to be completed in 2025. Another potential project under consideration to improve EFWS coverage on the City's Westside is a saltwater pump station along the Pacific Ocean. The EFWS system currently has two saltwater pump stations along the Bayfront, but none along the Pacific coast.
- While the EFWS Westside Phase I project would significantly improve coverage on the City's Westside, there would still be system coverage deficiencies in the south and southeastern areas of the City. The Excelsior and Visitacion Valley neighborhoods had low reliability scores in the SFPUC analysis of FRAs. The Board of Supervisors, in response to the 2018-19 Grand Jury report, requested SFPUC to develop a comprehensive EFWS citywide plan by December 31, 2021. As part of the comprehensive citywide plan, the City Administrator's Office, Mayor's Budget Office, SFPUC, and San Francisco Fire Department (SFFD) are analyzing whether to propose a stand-alone ESER bond dedicated solely to funding subsequent phases of the EFWS project.
- In addition to the EFWS, the City maintains a Portable Water Supply System (PWSS) consisting of hose tender trucks to assist with firefighting operations in areas not covered by the EFWS. Funding is available in FY 2020-21 to purchase three new hose tender trucks.
- In response to the 2018-2019 Civil Grand Jury report, the Board of Supervisors has requested SFPUC to complete analyses by June 30, 2021 of (i) additional seawater pump stations in San Francisco, include seawater pump stations on the Westside of San Francisco; and (ii) neighborhood firefighting water demands. As noted above, the Board has also requested SFPUC to prepare a comprehensive EFWS citywide plan by December 31, 2021. Given the risk of fires, especially after an earthquake, and the lack of sufficient EFWS coverage in the western and south/southeastern section of the City, the Board should ensure presentation of these reports in public hearings.

Project staff: Reuben Holober, Severin Campbell

Current Risks to the City's Emergency Firefighting Water Supply

The City is at risk for major fires following an earthquake. According to a 2014 study by the United States Geological Survey (USGS), San Francisco has a 72 percent chance of a magnitude 6.7 or larger earthquake (equivalent to the 1989 Loma Prieta earthquake) prior to 2043. According to a 1992 report to the National Science Foundation, the 1989 Loma Prieta earthquake caused 41 fires in San Francisco, largely due to electrical wiring and electric and gas appliances. One block in the Marina district was destroyed by fires caused by a broken gas distribution line. When access to nearby fire hydrants and the Palace of Fine Arts lagoon was insufficient to fight the fire, the Fire Department accessed water from the Bay, in which the Phoenix fire boat and three hose tenders were employed. Fire crews set up four major runs of five-inch hose between the fire and the boat using nine portable hydrants. Before all fire operations were concluded in the Marina District, the boat pumped 6,000 gallons per minute for more than 18 hours.[1]

The City completed the first water system for firefighting in 1913, following the 1906 San Francisco earthquake. The original Emergency Firefighting Water System (EFWS, also known as the Auxiliary Water Supply System, or AWSS) system consisted of (i) 72 miles of water pipes, concentrated heavily in the northeast part of the City around downtown; (ii) 889 hydrants; (iii) the Twin Peaks Reservoir; (iv) Ashbury and Jones Street tanks; and (v) Pump Stations 1 and 2. In 2010, San Francisco Public Utilities Commission (SFPUC) assumed responsibility for the operations and maintenance of the EFWS.

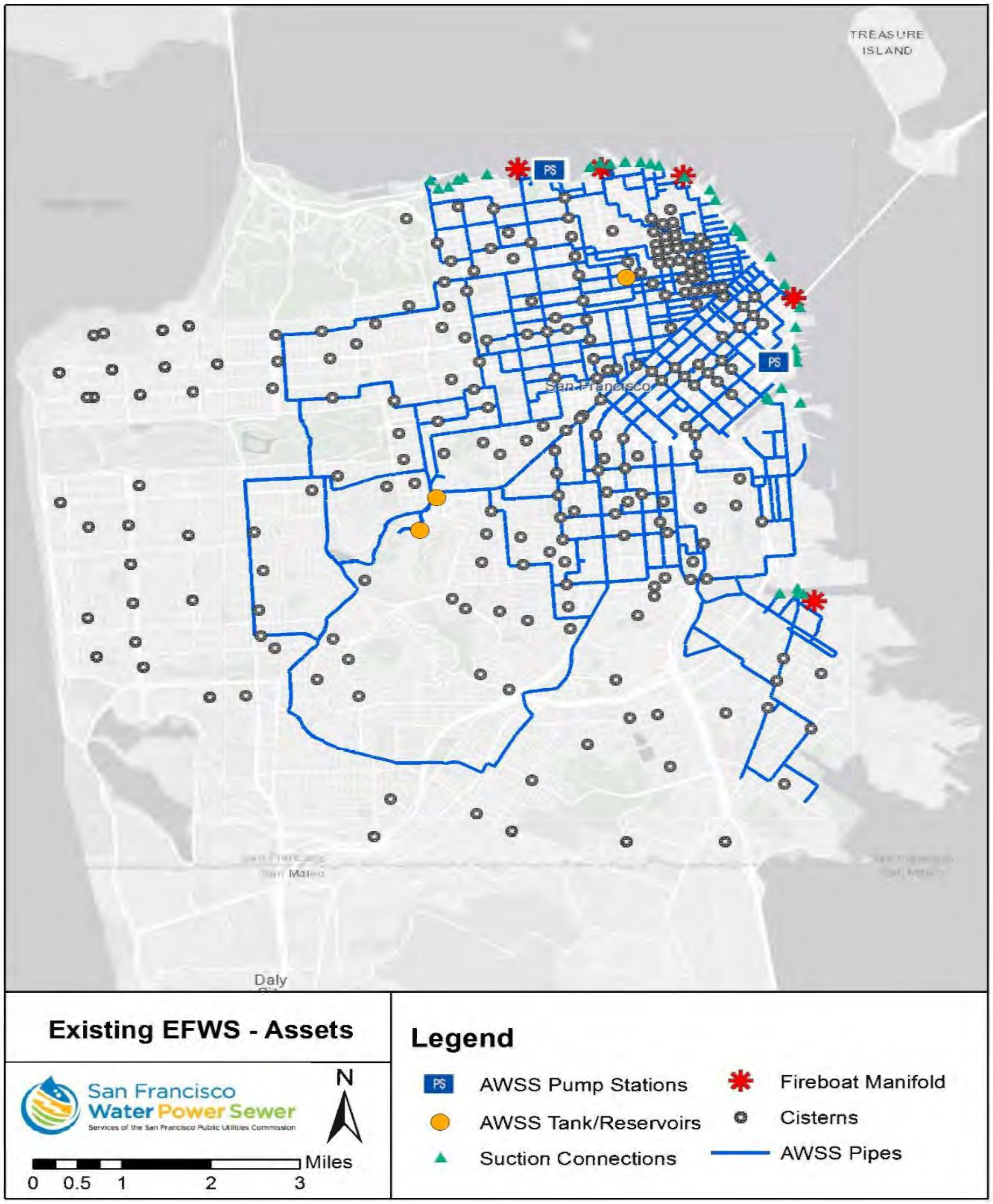
The EFWS has been expanded through funding from multiple bond measures over the years. The system now consists of approximately 130 miles of pipes, 229 cisterns, two pump stations, two water storage tanks, and a reservoir. The two seawater pump stations, as well as two fireboats, allow seawater from the San Francisco Bay to be injected into the EFWS. There are five manifolds that allow fireboats to inject seawater into the EFWS. There are 35 suction manifolds along the waterfront that allow seawater to be drawn from the bay and injected into the EFWS.

Limited Emergency Water Supply in Western and Southern Neighborhoods

The EFWS system is still heavily concentrated in the eastern half of the City, largely in the Downtown and South of Market areas. The western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited coverage. Furthermore, there are no pump stations in the western half of the City to pull water from the Pacific Ocean. Exhibit 1 below shows the existing EFWS system.

[1] *Investigation of Cause and Effects of Fires Following the Loma Prieta Earthquake*, Jamshid Mohammadi, Sam Aiyasin, D.N. Bak. Report to the National Science Foundation, 1992

Exhibit 1: Existing EFWS System Assets



Source: SFPUC

As shown in Exhibit 1, the western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited EFWS coverage.

Exhibit 2 below quantifies the existing EFWS assets by Supervisorial District.

Exhibit 2: EFWS Assets by Supervisorial District

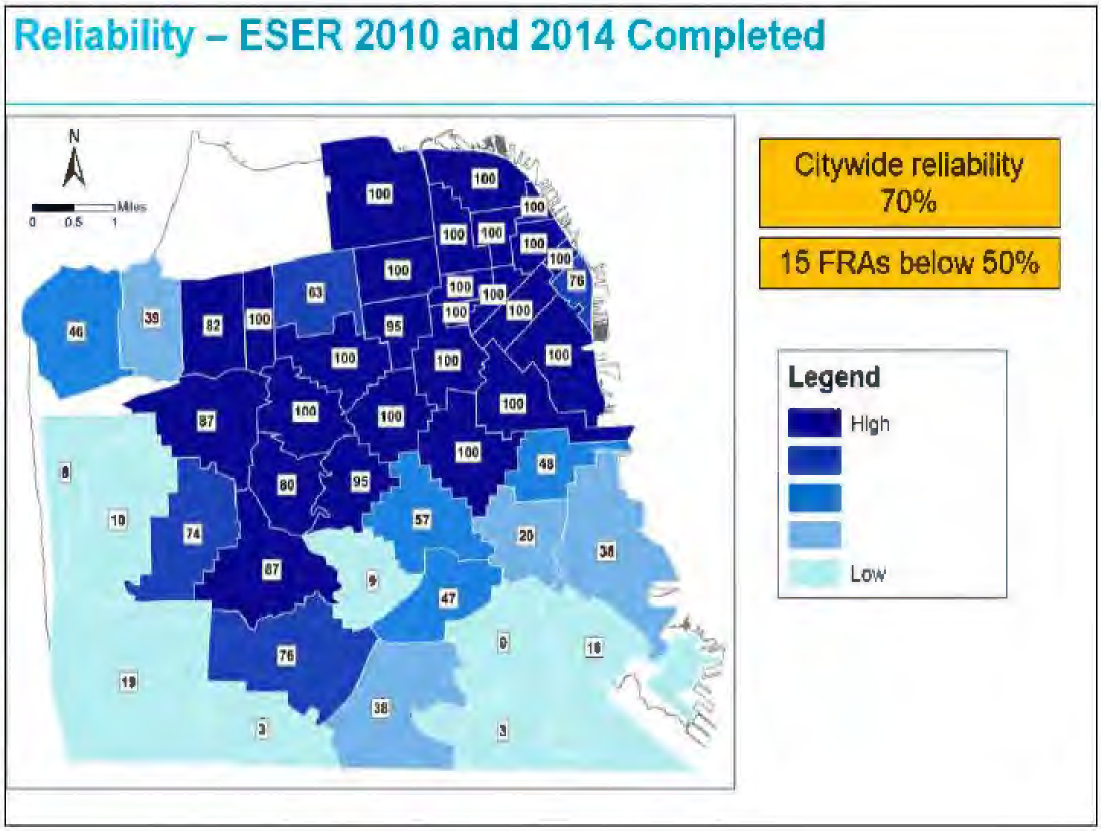
District	Number of EFWS Hydrants	Miles of EFWS Mains	Number of Cisterns
1	42	5	17
2	170	14	23
3	327	23	46
4	3	<1	12
5	188	16	20
6	366	27	26
7	79	7	12
8	110	9	27
9	110	9	21
10	222	18	20
11	24	1	5
Total	**1,641**	**130**	**229**

Source: SFPUC

Districts 1, 4, 7, and 11 have the fewest hydrants, miles of EFWS pipelines, and cisterns. District 4 has particularly poor coverage, with only three hydrants and less than 1 mile of pipeline. Conversely, Districts 3, 6 and 10 have the most hydrants, miles of EFWS pipelines, and cisterns.

SFPUC has conducted analysis to determine EFWS capability to meet median firefighting demands after a magnitude 7.8 earthquake. After voters approved Earthquake Safety and Emergency Response (ESER) bonds in 2010 and 2014, SFPUC was able to improve the EFWS system, including upgrading water supply reliability via projects at Twin Peaks Reservoir, EFWS tanks and pump stations, and adding 30 cisterns. Exhibit 3 below shows the EFWS reliability scores by Fire Response Area (FRA) following the 2010 and 2014 ESER bond improvements.

Exhibit 3: EFWS Reliability Score by FRA, Following 2010 and 2014 ESER Bonds Improvements



Source: SFPUC

The EFWS reliability scores by FRA largely mirror the map of the EFWS system buildout. Areas in the northeast portion of the City have high scores, while those in the western and southern portions of the City have lower scores. As noted in Exhibit 3, 15 FRAs have reliability scores below 50 percent. This means that after a 7.8-magnitude earthquake, these FRAs would have less than half the water supply necessary to meet the median firefighting demands.

By each of these metrics, it is clear that the western and southern portions of the City have the least sufficient water supplies needed for fires anticipated after a major earthquake. According to a fire modeling expert, the fire risk of a major earthquake subsumes the scope of all other types of fires possible in San Francisco, such as terrorist attacks, explosions, and wildfires.

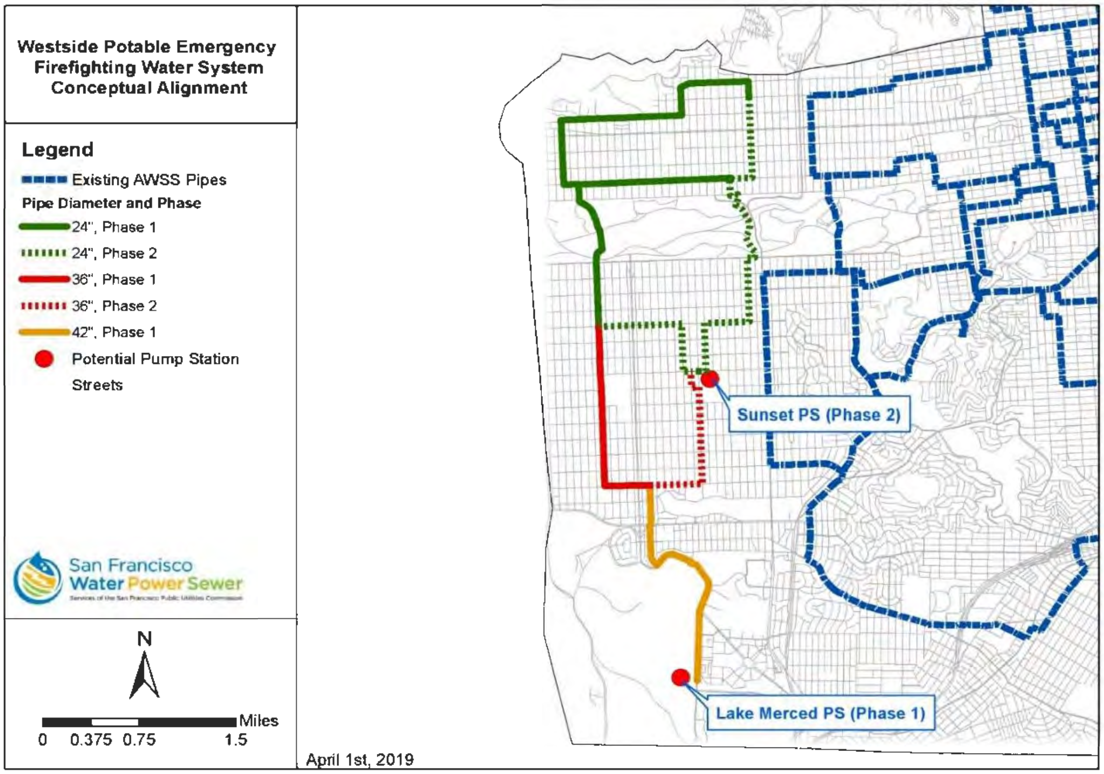
Options to Improve EFWS Access

Westside EFWS Options

In 2018, AECOM issued the report "Westside Emergency Firefighting Water System Options Analysis" on behalf of the SFPUC and San Francisco Fire Department (SFFD). The report analyzed 12 options for improving EFWS coverage in the Westside of the City. The options included both building off the existing EFWS system, or a potable EFWS system sourced from the Sunset Reservoir. Of the 12 options, the preferred option was Option 12, a potable EFWS system with a pump station at the Sunset Reservoir and loops around the Sunset and Richmond Districts. The estimated cost was approximately $109 million.

SFPUC has developed an updated conceptual Westside EFWS alignment based on Option 12 in the 2018 AECOM report. The key difference is that rather than only using Sunset Reservoir as a water source, the proposal would use Lake Merced as the primary source, and potentially use the Sunset Reservoir as a secondary source in a future project phase. Lake Merced contains approximately 1.2 billion gallons of water, while Sunset Reservoir only contains approximately 90 million gallons. However, Sunset Reservoir is supplied water via upgraded, seismically resilient pipelines that are connected to the SFPUC's Hetch Hetchy Regional Water System. The Westside EFWS Phase I project would connect Lake Merced to the Outer Sunset and Richmond neighborhoods, while Phase II would potentially connect a loop through the Inner Sunset and Richmond neighborhoods. A conceptual alignment of the Westside EFWS is shown in Exhibit 4 below.

Exhibit 4: Westside EFWS Conceptual Alignment



Source: SFPUC

The estimated cost of the EFWS Westside Phase I project is approximately $198 million. In March 2020, San Francisco voters approved Proposition B, a $628.5 million ESER bond that includes approximately $153.5 million for EFWS projects. The ESER bond funding, as well as approximately $55 million in Water Enterprise revenue bonds, totaling $203.5 million, provide sufficient funding to complete the EFWS Westside Phase I project by 2025, pending California Environmental Quality Act (CEQA) review. The issuance of up to $85 million in 2020 ESER bonds is currently pending Board of Supervisors approval (File 20-1295), and SFPUC anticipates receiving $20 million of the initial bond proceeds, which will be used for planning, design, and CEQA review for the Westside Phase I project and manifold projects at Fort Mason and Pier 33 ½.[2]

The estimated cost of the potential EFWS Westside Phase II project is $180 million for which funding has not yet been identified.

Another potential project that may improve EFWS coverage on the City's Westside is a saltwater pump station along the Pacific Ocean. The EFWS system currently has two saltwater pump stations along the Bayfront, but none along the Pacific coast. In response to the Civil Grand Jury report, the Board of Supervisors has directed

[2] The remaining $543.5 million in ESER bonds will likely be issued starting in the first half of 2021, with an initial sale of approximately $150-175 million. Of the remaining 2020 ESER bonds, $133.5 million is allocated to EFWS projects. The estimated cost in 2019 $s for the potential EFWS Westside Phase II is $180 million.

SFPUC to complete a study analyzing additional seawater pump stations in San Francisco, include seawater pump stations on the Westside of San Francisco by June 30, 2021.

Other EFWS Options

While the EFWS Westside Phase I project would significantly improve coverage on the City's Westside, there would still be system coverage deficiencies in other portions of the City, including the southeastern areas of the City. The Board of Supervisors has directed SFPUC to complete a more detailed analysis of neighborhood firefighting water demands by June 30, 2021, as well as a comprehensive EFWS citywide plan by December 31, 2021. As part of the comprehensive citywide plan, the City Administrator's Office, Mayor's Budget Office, SFPUC, and San Francisco Fire Department (SFFD) are analyzing whether to propose a stand-alone ESER bond dedicated solely to funding subsequent phases of the EFWS project.

Hose Tender Equipment

In addition to the EFWS, the City maintains a Portable Water Supply System (PWSS) to assist with firefighting operations in areas not covered by the EFWS. The PWSS consists of hose tender trucks that are equipped with approximately one mile of five-inch diameter hose, a portable pump, portable hydrants, and other firefighting equipment. Each fully equipped hose tender costs approximately $1 million. SFFD currently has five tenders, and all are between 28 and 47 years old and beyond their useful lives. These tenders are only able to transport hose and equipment and do not have pumping capabilities.

The FY 2019-20 budget included $4 million for four additional hose tenders, and SFFD also received $1 million in funding from the California Office of Emergency Services to purchase an additional hose tender, totaling $5 million for purchase of five hose tenders. However, due to the City's budget deficit from the COVID-19 pandemic, $2 million was reduced by the Mayor's Budget Office as part of the mid-year balancing plan. That leaves $3 million remaining to purchase three new hose tenders, and the units are currently out to bid by the Office of Contract Administration. These new hose tenders are more efficient and maneuverable than older models. They contain pumps that can siphon water from the Bay, reservoirs, or other sources. The hoses can be connected to carry water several miles from the source. The City Attorney's Office has determined that ESER bonds may not be used to purchase hose tender equipment, so they must be purchased from the General Fund or grant funds.

Emergency Firefighting Water System: Annual Report FY 2019-2020

John Scarpulla, SFPUC
Heather Green, Office of Resilience and Capital Planning

San Francisco Water Power Sewer

ONESF Building Our Future

What is the EFWS?

- Emergency Firefighting Water System (EFWS): A high-pressure fire-suppression water system built after 1906 earthquake.
- Hetch Hetchy Regional Water System = Primary Source of Water
- EFWS ownership transferred to SFPUC in 2010
- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works
- Hydraulic modeling utilized to guide decision making.

San Francisco Water Power Sewer

ONESF Building Our Future

Resolution 484-19

- Urged the following:
  - By June 30, 2021: complete a study analyzing EFWS seawater supplies.
    - In Progress
  - By June 30, 2021: complete a more detailed analysis of neighborhood firefighting water demands.
    - In Progress
  - By December 31, 2021: develop a comprehensive citywide EFWS plan.
    - In Progress
  - **Annual Report submitted each June 30.**

Annual Report – FY 19-20: EFWS Used at Fires

- **Feb 29, 2020:**
  - Toland St. & Evans St.
  - 4 Alarm Fire

- **May 23, 2020:**
  - Pier 45
  - 4 Alarm Fire

Annual Report – FY 19-20: Capital Projects

- **Completed:**
  - Ashbury Bypass EFWS Pipeline
  - Terry Francois & Mariposa EFWS Pipeline
  - Irving Street EFWS Pipeline
  - Pump Station No. 1 Upgrades
- **Under Construction:**
  - Pump Station No. 2 Upgrades
- **Construction in FY 20-21:**
  - 19^{th} Ave EFWS Pipeline
  - Clarendon Supply EFWS Pipeline
  - Terry Francois/Mission Rock/Warriors Way EFWS Pipeline
- **Additional work in FY 20-21:**
  - Westside Potable EFWS: Environmental Review, Planning, and Design
  - Street Valve Motorization: Bidding

Annual Report – FY 19-20: Development Projects

- **Installed EFWS Infrastructure**:
  - Pier 70
  - HopeSF Sunnydale
- **Development Agreement Approved With EFWS Infrastructure:**
  - Potrero Power Station
  - 3333 California Street
- **Development Agreement With EFWS Infrastructure Pending Approval:**
  - Balboa Reservoir

Annual Report – FY 19-20: Maintenance

- **Over 27,000 hours of maintenance performed on the City's Firefighting Water Infrastructure.**

- **Highlighting Tasks:**
  - Hydrant Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Seawater Suction Connection Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Reservoir and Cistern Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Fixing Pipeline Leaks
  - Pump and Generators Inspections and Preventive & Corrective Actions
  - Valve Inspections and Preventive & Corrective Actions

Annual Report – FY 19-20: Drills, Special Projects, and Meetings

- Pier 90 Seawater Manifold Drill (SFFD & Fireboat & SFPUC)
- Bay Bridge Pump Station & Standpipe Drill (SFFD & SFPUC)
- 5″ Hose Tender Drills (SFFD)
- SFFD & SFPUC 5″ Hose Tender Drill (*planning completed*)
- Bay Dredging Near Seawater Inlets (SFFD & Port)
- SFFD & SFPUC Joint Agency EFWS Meetings
- SFFD & RPD Joint Agency Meetings

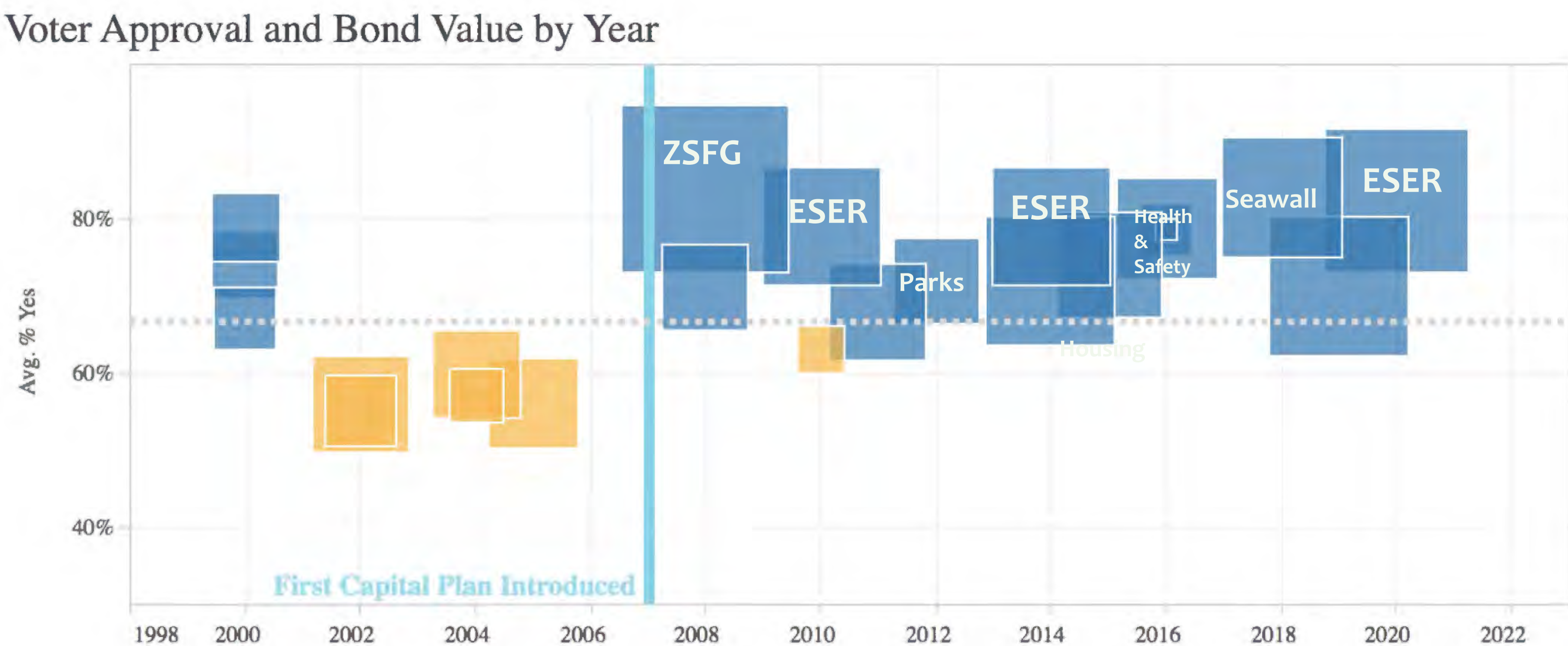
San Francisco Water Power Sewer
ONESF Building Our Future

Updating SFPUC/SFFD MOU

➢ *Memorandum of Understanding Regarding the Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression*

- Signed in 2015 by SFFD and SFPUC
- Updating it to better detail and memorializing exercises and drills utilizing EFWS
- Expected to be completed in 2020.

Voter Approval of G.O. Bond Measures since 2000



ESER 2020 Bond Programming

- $628.5M total
- **$153.5M Emergency Firefighting Water System (EFWS)**
- $275M - Fire Training and Station Facilities
- $121.5 - Police Station Facilities
- $70M - Disaster Response Seismic Improvements
- $9M - 1011 Turk (911 Call Center)

San Francisco Water Power Sewer

ONESF Building Our Future

EFWS per Bond Report

The selection of ESER 2020 projects will be guided by the system's technical steering committee, which consists of senior technical and operational managers from the Fire Department, Public Works and the San Francisco Public Utilities Commission. The Management Oversight Committee, which includes the fire chief, Public Works director, general manager of the San Francisco Public Utilities Commission and the assistant general manager of the Water Enterprise of the San Francisco Public Utilities Commission, will determine the list of ESER 2020 projects. The recommendations and decisions of these two committees will take into consideration the findings of the California Environmental Quality Act (CEQA) environmental review process.

Questions?

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

DATE: June 25, 2020

TO: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Harlan L. Kelly Jr., General Manager of the SFPUC
Jeanine Nicholson, Chief of the Department, San Francisco Fire Department

SUBJECT: Fiscal Year 2019-2020 Annual Emergency Firefighting Water System Report

---

Pursuant to Resolution No. 484-19, the San Francisco Public Utilities Commission and San Francisco Fire Department hereby provide the following report on the City's Emergency Firefighting Water System (EFWS). Resolution No. 484-19 urges the departments provide a consolidated annual report to the Board of Supervisors, "...on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan."

This report addresses the information requested in Resolution No. 484-19 and provides an update on the City's EFWS preparedness.

Program Background

The San Francisco EFWS is vital for protecting against the loss of life resulting from multi-alarm fires, as well as the loss of homes and businesses by providing an additional layer of fire protection. The system is used throughout the year for the suppression of multiple-alarm fires. The system delivers water at high pressure to the SFFD for firefighting purposes. The primary source of water is the SFPUC's Hetch Hetchy Regional Water System, which supplies water to one reservoir and two storage tanks. The water is subsequently supplied from the reservoirs and tanks into 135 miles of pipelines. The secondary source of water for the EFWS is the San Francisco Bay. There are two seawater pump stations that can supply seawater into the pipelines, as well as 35 suction connections along the northeastern waterfront, which allow fire engines to pump water from the Bay. Finally, two fireboats are available to supply seawater by pumping into any of the five manifolds connected to pipelines.

In 2010, 2014, and 2020, San Francisco voters approved three Earthquake Safety and Emergency Response (ESER) General Obligation Bonds, allowing

the City to make critical public safety investments and upgrades to emergency response facilities and infrastructure, including the EFWS.

With the passage of each ESER bond, the SFPUC, SFFD, Public Works, and the Office of Resilience and Capital Planning in the City Administrator's Office have made it a high priority to evaluate, plan, repair, upgrade, and expand EFWS infrastructure throughout San Francisco. In addition to ESER funded upgrades, large development projects in San Francisco have also installed EFWS infrastructure within and adjacent to project boundaries.

2020 Earthquake Safety and Emergency Response Bonds

In March of this year, San Francisco voters approved the 2020 Earthquake Safety and Emergency Response General Obligation Bond. That bond's programming included $153.5 million for the Emergency Firefighting Water System. That funding will be allocated to replace, extend and seismically upgrade system components to increase the ability to provide adequate water throughout the City for firefighting following a major earthquake and during multiple-alarm fires.

With the ESER funding, many upgrades will focus on improving EFWS capabilities in the City's western neighborhoods. The results and recommendations of the 2018 *Westside Emergency Firefighting Water System Options Analysis* planning study will help to inform the selection and design of specific projects to be funded through ESER 2020. Upon the completion of required environmental review, construction will proceed for selected projects.

Capital Projects: Fiscal Year 2019 – 2020

During Fiscal Year 2019-2020, ESER bond funds were utilized on a total of 10 capital projects, funding the installation of EFWS infrastructure and/or funding engineering and planning work in advance of installing the infrastructure. Please refer to Table 1 for more information.

Table 1: ESER Bond Funded EFWS Projects

<table>
<tr><th>Project</th><th>Status</th></tr>
<tr><td>Ashbury Bypass EFWS Pipeline</td><td rowspan="4">Completed</td></tr>
<tr><td>Terry Francois & Mariposa EFWS Pipeline</td></tr>
<tr><td>Pump Station No. 1</td></tr>
<tr><td>Irving Street EFWS Pipeline</td></tr>
<tr><td>Pump Station No. 2 Upgrades</td><td>Under Construction</td></tr>
<tr><td>Terry Francois/Mission Rock/Warriors Way EFWS Pipeline</td><td rowspan="3">Construction will begin FY 2020-21</td></tr>
<tr><td>Clarendon Supply EFWS Pipeline</td></tr>
<tr><td>19th Ave. EFWS Pipeline</td></tr>
<tr><td>Potable Emergency Firefighting Water System</td><td>Planning and Design</td></tr>
<tr><td>Street Valve Motorization</td><td>Bidding</td></tr>
</table>

Technical Studies	Continuing
Administration	

Development Projects: Fiscal Year 2019 – 2020

Additionally, the SFPUC and SFFD coordinate with project sponsors of large development projects to ensure the installation of EFWS infrastructure within and adjacent to their respective projects. Please see Table 2 for development projects that installed or committed to install EFWS infrastructure this Fiscal Year.

Table 2: Development Projects: EFWS

Project	Status
Pier 70	Installed EFWS Infrastructure
HopeSF Sunnydale	
Potrero Power Station	EFWS Infrastructure included in Approved Development Agreement.
3333 California	
Balboa Reservoir	EFWS Infrastructure included in Development Agreement (Pending Approval)

Active Fires, Trainings, and Inspections: Fiscal Year 2019-2020

Additionally, the SFFD, SFPUC, and other agencies used EFWS infrastructure for trainings and active fires, performed routine inspections, and held joint meetings to discuss emergency response planning and project priorities. A summary of the SFFD's EFWS activities and partners for Fiscal Year 2019-2020 is provided in Table 3.

Table 3: Summary of SFFD EFWS Activity

Date	Participants	Activity
11/20/2019	**SFFD:** Fireboat St. Francis, E35, E08, E29, B03, D3, ADC Michael Cochrane, Deputy Chief Victor Wyrsch, Water Supply Officer Brent Stuckert, Division of Training Staff and members of the Bureau of Equipment. **SFPUC**: EFWS Superintendents, Utility Plumbers, Hydrant Gatemen, plumbers and members of the engineering Department	***Pier 90 salt-water inlet manifold drill*** The Fireboat St. Francis supplied salt water to a portion of the EFWS that had been isolated by the SFPUC to operate multiple high-pressure hydrants and a deck gun.
12/12/2019	**SFFD:** Deputy Chief Victor Wyrsch, Deputy Chief Jose Velo, Assistant Deputy Chief Dawn DeWitt, Assistant Chief	***Joint Agency Q&A and group discussion*** Improvements made to the EFWS

Date	Participants	Activity
	Brook Baker; Assistant Chief Robert Postel, Water Supply Officer Captain Brent Stuckert, Division of Training Staff and numerous Battalion Chiefs **SFPUC:** Rich Gonzales, Sean Duffy, Kevin O'Connor and Ryan Gabriel.	since the 1989 earthquake, strategies to further improve the system in its current configuration, agency response plans in the event of a large-scale disaster, and interagency drills that will be conducted on a quarterly basis.
02/29/2020	**SFFD**: 4th Alarm Fire at Toland St. / Evans St. **SFPUC**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations for this 4th Alarm Fire
3/03/2020	**SFFD:** E01, E35, B03, Water Supply Officer Captain Stuckert. **SFPUC:** Superintendent Rich Gonzales, Utility Plumbers and Hydrant Gatemen, Superintendent of Facilities Operations Brahman Conci	***Bay Bridge Pump Station and Standpipe drill*** This was a joint operation that required close coordination between the SFFD and the SFPUC and satisfied recommendation R10 of the 2019 Civil Grand Jury Report on the EFWS. The drill simulated a large-scale fire event on the west span of the Bay Bridge that would require more water than the 500 gallons that are carried by a single SFFD engine. This was the first time a drill of this nature has been performed and resulted in new standard operating procedures for disaster events on the Bay Bridge.
05/23/2020	**SFFD:** 4th Alarm Fire at Pier 45 **SFPUC**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations and to supply 5" hose provide by the hose tenders. The St. Francis Fireboat was put into operation and saved the historic Liberty Ship SS Jeremiah O'Brien from being destroyed by this 4th Alarm Fire.
10/26/*2019* 11/16/2019 12/21/2019 12/28/2019 01/25/2020	**SFFD:** Multiple engine companies and Battalion Chiefs	***5" Hose drills*** Regularly scheduled drill using 5" hose tenders and high pressure hydrants, ladder pipes and/or

Date	Participants	Activity
02/15/2020 05/04/2020 05/09/2020 05/16/2020		monitor nozzles/deck guns.
In Progress	**SFFD**: Water Supply Officer Captain Brent Stuckert **Rec & Park:** David Iribarne	***Joint Agency Discussion*** SFFD has contacted Rec and Parks asking them to consider adding more hydrants inside Golden Gate Park. The Urban Tree Canopy is now being taken into consideration in the latest Fire Following Earthquake models, and Golden Gate Park has a large amount of both surface and canopy fuel loads.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stucker **Port:** Shannon Alford	***Bay Dredging near salt-water inlet manifold.*** SFFD has been working with the SF Port to schedule dredging adjacent to the salt-water inlet manifold located on piers to ensure the St. Francis fireboat has adequate draft to perform pump operations through a complete 24-hour tidal cycle. SFFD has also requested the area near the Pump Station No. 1 inlet tunnel to be included in Port's dredging boundary. This inlet tunnel must be kept clear to allow the Pump Station to provide seawater to the EFWS.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stuckert, B07, 5" Hosetender **SFPUC:** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineers.	***SFFD-SFPUC Joint 5" Hose Drill*** Preparations have begun for a 5" Hose Tender Drill involving SFFD and SFPUC. SFPUC will assist with measuring exact pressures and water flow in the 5" lines to determine optimal placement of the 5" hose and engines for relay pumping operations. Relay pumping will be required to deliver water long distances and to the higher elevations of San Francisco. These preparations will increase the City's resilience by

Date	Participants	Activity
		mitigating the projected multiple post seismic ignitions. (This drill has been delayed due to the pandemic and will be conducted when normal operations can be resumed.)
In Progress	**SFFD:** Water Supply Officer Captain Brent Stuckert **SFPUC:** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***Bay Suction Connection Inspection Program*** Inspection and maintenance of the 35 Bay Suction Connections that are situated along the San Francisco Waterfront. These connections are used by SFFD engine companies to draft water from the Bay.
In Progress	**SFFD**: SFFD engine companies, Water Supply Officer Captain Stuckert. **SFPUC:** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***High Pressure Hydrant Inspection Program*** A High Pressure Hydrant Inspection program has been implemented. The SFFD and SFPUC are collectively inspecting and repairing the 1,644 High Pressure Hydrants in the City.

Maintenance Projects: Fiscal Year 2019 – 2020

Over the past year, the City Distribution Division (CDD) of the SFPUC completed numerous important maintenance activities to ensure that the EFWS is in a state of good repair. A summary of maintenance activities can be found in Table 4 of this report (page 7).

Update on Memorandum of Understanding

In 2015, the SFPUC and SFFD signed the *Memorandum of Understanding Regarding the Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression*. The SFPUC and SFFD are actively collaborating to update this Memorandum of Understanding to better detail and memorialize annual emergency response exercises, including simulated disaster and earthquake drills involving the EFWS. The timeline on this update has been delayed due to Coronavirus response; however, SFPUC and SFFD expect this update to be completed in 2020.

Table 4: Summary of Maintenance Activities

Facility Type	Facility	Activity Category	Type of Activity	Typical Frequency	Date Range: Jul 1, 2019 - June 15, 2020	
					Work Performed (Labor Hours)	Total Quantity of Maintenance Activities
Hydrants	Low Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect Condition Hydrant and Auxiliary Valve	296	Quantity inspected available upon request
			Condition Assessment*- College Hill Pressure Zone Hydrants and Valves	May 5, 2019 through July 16, 2019	556	932
			Hydrant Corrective Maintenance & Preventative Maintenance Activities	Ongoing	2,413	538
			Replace Caps & Chains and Service Hydrants	SFFD Requests	2,513	Quantity serviced and repaired available upon request
			Hit Hydrants	As Needed	483	57
			Preventative Maintenance	Ongoing by AWSS District	708	Quantity serviced available upon request
			Auxiliary Gate Valve Maintenance	Remove Debris and Uncover Aux. Gate Valves	515.5	98
		New Hydrants Installed	Replace/Install/Relocate Hydrants	As Needed	N/A	233

	High Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect and Document Condition of King Valves	1,793	Quantity inspected available upon request
			Hydrant Maintenance	Upon SFFD Request and Proactive Follow up Work from Inspections	2,966	508
			Rebuild High Pressure Hydrants and Scrap	Corrective - to support CM and Service Hydrant Program	2,015	N/A
		New Hydrants Installed	Install New High Pressure Hydrants	Redevelopment Projects	N/A	3
	Combined Low/High Pressure	Paint Hydrants	Paint Hydrant - Vandalism and Reported by SFFD	Ongoing	4,836	Labor based on Standing Work Orders
System Pipes		Replace and Renew Main Pipes	Main Pipe Leaks	As-needed	332	2
		Replace and Renew Hydrant Leads	Hydrant Leads	As-needed	860	5
Valves		Maintenance	Exercise Critical Valves	Once every 2 years	0*	Exercised 63 Critical Valves FY 18/19; To Exercise all valves FY 20/21
			Valve Vault Maintenance, Pump Flooded Vaults, Electrical and Mechanical Inspections	Corrective Maintenance based on FY 17/18 Survey	273	Location Details Available Upon Request
			System Valve Renewal	As-needed	783	6
			Altitude Valve Inspections	As-needed	15	-

			Inspect, Test, and Repair Valves/Actuators	As-needed	0	-
		Ames Valve Testing	Test Ames Valves	Ongoing	476	Quantity inspected available upon request
Pump Stations	PS1	Maintenance	Pump Testing and Backup Generator	Monthly	934	-
	PS2	Maintenance	Pump Testing and Emergency Backup Generator	BiMonthly	16	-
Tanks	Jones Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing and Backup Generator	Monthly	16	-
	Ashbury Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing	BiMonthly	4	-
Reservoir	Twin Peaks Reservoir	Maintenance	Inspect & Fill Twin Peaks Reservoir	As-needed	90	-
Cisterns		Maintenance & Inspections	Repair/Replace Cistern Handles, Fill Cisterns	As-needed	357	173
Suction Connections & Manifolds		Maintenance	Connection/Manifold Inspections and SFFD Dive Team Assistance	As-needed	0**	PM program scheduled for FY20/21
Manifold		Maintenance	Fire Boat Testing/Training	As-needed	185	-
Other Support		Maintenance/Operations Support	Instrumentation and Controls Calibration at all AWSS Facilities	Monthly	305	-
			Planning Support and Administration	Field Staff Planning and Supervisorial (Non-Management Labor)	2,057	-
			Landscaping & Pest Management	Quarterly	692.5	-

		Materials Management	As-needed (Includes only Non-Warehouse Staff Labor Charges)	767	-

<u>Notes</u>

* AWSS critical valves were exercised in FY18/19 and are scheduled to be exercised in FY20/21 (two-year cycle)

** Bay suction manifolds preventative maintenance program is scheduled for FY20/21

[Declaring a State of Urgency - Expanding the City's Emergency Firefighting Water System]

Resolution declaring a State of Urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

WHEREAS, The United States Geological Survey (USGS) estimates that the probability an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent; and

WHEREAS, In San Francisco, the most densely populated city in California, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings, and earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo, and San Francisco remains highly vulnerable to fire after an earthquake, as explained in a 2008 article for the *International Association for Fire Safety Science*; and

WHEREAS, The San Francisco Fire Department (SFFD), the San Francisco Public Utilities Commission (SFPUC), and this Board of Supervisors share a common goal of increasing the firefighting capabilities of all areas of San Francisco; and

WHEREAS, The EFWS is a high-pressure and volume fire suppression water system that can be utilized during large fires and is vital for protection against the loss of life, homes, and businesses from fire following a major earthquake and non-earthquake multiple-alarm fires; and

WHEREAS, The EFWS does not cover large parts of nor adequately protect Supervisorial Districts 1, 4, 7, and 11, roughly one-third of the City's developed area, which also have the fewest cisterns, and each fewer than ten miles of EFWS mains and fewer than 50 EFWS fire hydrants; and

WHEREAS, In June 2003, the 2002-2003 Civil Grand Jury recommended that the EFWS be extended "to serve all parts of the City," and 16 years later many neighborhoods still do not have new EFWS pipelines; and

WHEREAS, The SFPUC is developing a preliminary list of potential projects for various parts of the City where there is currently limited access to the EFWS, as well as other projects to reinforce or otherwise improve the existing EFWS; and

WHEREAS, The City does not have an agreed-upon timeline to fund and complete development of EFWS for all areas of the City, including neighborhoods that historically have not been as well protected as other areas of the City; and

WHEREAS, Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before some parts of the City have a high-pressure and volume, multi-sourced, seismically safe emergency firefighting water supply; and

WHEREAS, While the amount of money needed to implement EFWS citywide is estimated to be in the hundreds of millions of dollars, the potential loss of life and potential property damage could be far greater if an extremely large earthquake strikes San Francisco; and

WHEREAS, Based on the City's current pace of issuing ESER Bonds, it could take approximately 35 years or more to build out EFWS pipelines to serve all neighborhoods, unless the timing of the ESER Bond issuances are expedited or other sources of funding are identified; and

WHEREAS, SFPUC and SFFD are in the process of analyzing the best method for bringing a robust and resilient high-pressure and volume firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and are examining several options for the Westside, including potential development of a potable EFWS with over 14 miles of new EFWS pipelines and two new pump stations that could be supplied by four water sources; and

WHEREAS, To best utilize the existing EFWS and serve areas where the EFWS is lacking, it is critical that the SFFD obtain new updated Hose Tenders; and

WHEREAS, SFFD hose tenders are specialized apparatus designed for pumping and transporting large volumes of water from any source, are recognized worldwide for their ability to successfully move large amounts of water to a fire at high-pressures and volumes for firefighting, and are the ideal solution for areas with limited access to the EFWS because these vehicles can be dynamically deployed to any area of the City; and

WHEREAS, The SFFD currently has five Hose Tenders, three from 1973, one from 1987, and one from 1992, all of which are two-wheel drive, and do not have the capacity to draft or pump water; and

WHEREAS, In FY2019-2020 SFFD submitted a request for funding to purchase 20 Portable Water Supply System (PWSS) hose tenders, the Board of Supervisors and Mayor funded four new PWSS hose tenders, and the State of California funded one; and

WHEREAS, On October 8, 2019, Supervisor Gordon Mar requested the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board no later than December 31, 2020 (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term; and

WHEREAS, On October 1st, 2019, the San Francisco Board of Supervisors adopted a Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," on file with the Clerk of the Board of Supervisors in File No. 190786, which is hereby declared to be a part of this Resolution as if set forth fully herein; now, therefore, be it

RESOLVED, That the Board of Supervisors hereby declares a State of Urgency to rapidly expand the City's EFWS to protect all neighborhoods in the event of a major earthquake and fire, given that the vulnerability of the City poses a serious and urgent threat to the well-being of San Francisco and the safety of its inhabitants and environment; and be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC, SFFD and the Office of Resilience and Capital Planning to develop a comprehensive EFWS action plan, including funding sources, to install a high-pressure and volume, multi-sourced, seismically safe emergency water system to fight fires in the event of a major earthquake in all the parts of the City where it is lacking by June 30, 2034, to be submitted to the Board of Supervisors by December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC and SFFD to complete a study for adding an EFWS saltwater pump station on the Westside of San Francisco to be presented to the Board no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC to continue its efforts to complete more detailed analysis of emergency firefighting water needs by neighborhood and prepare a completed analysis by June 30, 2021; and, be it

FURTHER RESOLVED, That by June 30, 2022, the City should analyze whether to propose a separate bond for the development and implementation of EFWS projects for areas of the City with limited EFWS access as part of the City's regular capital planning process; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to prioritize funding for the purchase of new PWSS hose tenders, apparatus, and equipment to replace and expand SFFD's currently inadequate inventory within the next three Fiscal Years; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Department of Emergency Management, SFPUC, SFFD, and the Office of Resilience and Capital Planning to provide a consolidated annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan for EFWS by June 30 of each year, with the first report due June 30, 2020.

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

City and County of San Francisco
Tails
Resolution

File Number: 191029 **Date Passed:** November 19, 2019

Resolution declaring a state of urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

November 08, 2019 Public Safety and Neighborhood Services Committee - RECOMMENDED

November 19, 2019 Board of Supervisors - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

November 19, 2019 Board of Supervisors - ADOPTED AS AMENDED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 191029

I hereby certify that the foregoing Resolution was ADOPTED AS AMENDED on 11/19/2019 by the Board of Supervisors of the City and County of San Francisco.

f Angela Calvillo
Clerk of the Board

Unsigned
London N. Breed
Mayor

11/27/19
Date Approved

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Peggy Nevin

for Angela Calvillo
Clerk of the Board

11/27/19

Date

File No.
191029

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

October 15, 2019

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Department 206
San Francisco, CA 94102

RE: Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Dear Judge Wong:

The Board of Supervisors' Government Audit and Oversight Committee conducted a public hearing on September 19, 2019, to review the findings and recommendations of the 2018-2019 Civil Grand Jury report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Prior to the Committee meeting, the following City Departments submitted required responses to the Civil Grand Jury:

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;
- Fire Department:
  Received September 16, 2019;
- City Administrator:
  Received September 16, 2019; and
- Department of the Environment
  Received September 16, 2019.

Continues on next page

During the September 19, 2019 meeting, the Government Audit and Oversight Committee prepared a resolution responding to the requested findings and recommendations identified in the report. The response was prepared by Resolution No. 422-19, enacted on October 11, 2019.

By this message, the Office of the Clerk of the Board of Supervisors is transmitting Resolution No. 422-19 to your attention.

If you have any questions, please contact John Carroll, Government Audit and Oversight Committee Clerk at (415) 554-4445, or via email to john.carroll@sfgov.org.

Sincerely,

Alisa Somera

f Angela Calvillo
Clerk of the Board

c:
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Mark de la Rosa, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Ettore Leale, 2019-2020 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

City and County of San Francisco

Certified Copy

Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

190786 **[Board Response - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]**

Sponsor: Mar

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget. (Clerk of the Board)

10/1/2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

10/11/2019 Mayor - RETURNED UNSIGNED

STATE OF CALIFORNIA
CITY AND COUNTY OF SAN FRANCISCO

CLERK'S CERTIFICATE

I do hereby certify that the foregoing Resolution is a full, true, and correct copy of the original thereof on file in this office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the offical seal of the City and County of San Francisco.

October 15, 2019
Date

Angela Calvillo
Clerk of the Board

FILE NO. 190786 RESOLUTION NO. 422-19

[Board Response - Civil Grand Jury Report - Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

WHEREAS, Under California Penal Code, Section 933 et seq., the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on the findings and recommendations contained in Civil Grand Jury Reports; and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), if a finding or recommendation of the Civil Grand Jury addresses budgetary or personnel matters of a county agency or a department headed by an elected officer, the agency or department head and the Board of Supervisors shall respond if requested by the Civil Grand Jury, but the response of the Board of Supervisors shall address only budgetary or personnel matters over which it has some decision making authority; and

WHEREAS, Under San Francisco Administrative Code, Section 2.10(a), the Board of Supervisors must conduct a public hearing by a committee to consider a final report of the findings and recommendations submitted, and notify the current foreperson and immediate past foreperson of the civil grand jury when such hearing is scheduled; and

WHEREAS, In accordance with San Francisco Administrative Code, Section 2.10(b), the Controller must report to the Board of Supervisors on the implementation of

recommendations that pertain to fiscal matters that were considered at a public hearing held by a Board of Supervisors Committee; and

WHEREAS, The 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" ("Report") is on file with the Clerk of the Board of Supervisors in File No. 190785, which is hereby declared to be a part of this Resolution as if set forth fully herein; and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors and the Budget and Legislative Analyst respond to Finding Nos. F6, and F11, as well as Recommendation No. R3, contained in the subject Report; and

WHEREAS, Finding No. F6 states: "Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply;" and

WHEREAS, Finding No. F11 states: "The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods;" and

WHEREAS, Recommendation No. R3 states: "The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020;" and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors respond to Finding Nos. F4, and F5, as well as Recommendation Nos. R1, R2, R4, R6, R7, and R8, contained in the subject Report; and

WHEREAS, Finding No. F4 states: "The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake;" and

WHEREAS, Finding No. F5 states: "A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City;" and

WHEREAS, Recommendation No. R1 states: "By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake;" and

WHEREAS, Recommendation No. R2 states: "The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034;" and

WHEREAS, Recommendation No. R4 states: "As an interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory;" and

WHEREAS, Recommendation No. R6 states: "The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations

from this study should be presented to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R7 states: "The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R8 states: "By no later than June 30, 2022, the Mayor and Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034;" and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on Finding Nos. F4, F5, F6, and F11, as well as Recommendation Nos. R1, R2, R3, R4, R6, R7, and R8 contained in the subject Report; now, therefore, be it

RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F4; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F5; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F6; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F11; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R1 has not been implemented but will be implemented no later than December 31, 2021,

and urges the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning to jointly present a detailed plan to the Board of Supervisors by no later than December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R2 has not been implemented but will be implemented by December 31, 2021, and urges the Departments to include in its detailed plan a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R3 has not been implemented but will be implemented in the future, and Supervisor Gordon Mar will issue a request for a Budget and Legislative Analyst report no later than December 31, 2019, and will direct the Budget and Legislative Analyst to issue the completed report no later than December 31, 2020; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R4 will not be implemented because while funding for five hose tenders was allocated for FY2019-2020 though both local and state-level actions, implementation of the recommendation in its entirety will depend on the appropriation actions of a future Mayor and Board of Supervisors; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R6 has not been implemented but will be implemented in the future, and urges the completion of a study for adding a salt-water pump stations to be presented to the Board of Supervisors by no later than June 30, 2021, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R7 has not been implemented but will be implemented in the future, and urges that a

completed analysis be presented to the Board of Supervisors by no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R8 has not been implemented but will be implemented in the future, and will analyze by June 30, 2022, in coordination with the Mayor, whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to cause the implementation of the accepted findings and recommendations through his/her department heads and through the development of the annual budget.

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 190786 **Date Passed:** October 01, 2019

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

September 19, 2019 Government Audit and Oversight Committee - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

September 19, 2019 Government Audit and Oversight Committee - RECOMMENDED AS AMENDED

October 01, 2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 190786

I hereby certify that the foregoing Resolution was ADOPTED on 10/1/2019 by the Board of Supervisors of the City and County of San Francisco.

Alisa Somera

for Angela Calvillo
Clerk of the Board

Unsigned

London N. Breed
Mayor

10/11/2019

Date Approved

File No. 190786

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Alisa Somera
for ~~Angela~~ ~~Calvillo~~
Clerk of the Board

10/11/2019
Date

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **19-0178**

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capitel plenning process gathers, documents, and balances plenned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of thet commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementery sources thet could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthqueke (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the egency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Frencisco thet is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locetions ere entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenence/testing records, reguler maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.						

2018-2019 CIVIL GRAND JURY FINDINGS, RECOMMENDATIONS, AND RESPONSES TO FINDINGS AND RECOMMENDATIONS

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about en hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disester. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Frencisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 (for F4)	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be Implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir thet could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regionel Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implemant a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

1 DR. CARLTON B. GOODLETT PLACE, ROOM 200
SAN FRANCISCO, CALIFORNIA 94102-4681
TELEPHONE: (415) 554-6141

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

Civil Grand Jury 2018-19 Report:

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

John Scarpulla
SFPUC

San Francisco Water Power Sewer

ONESF
Building Our Future

What is the EFWS?

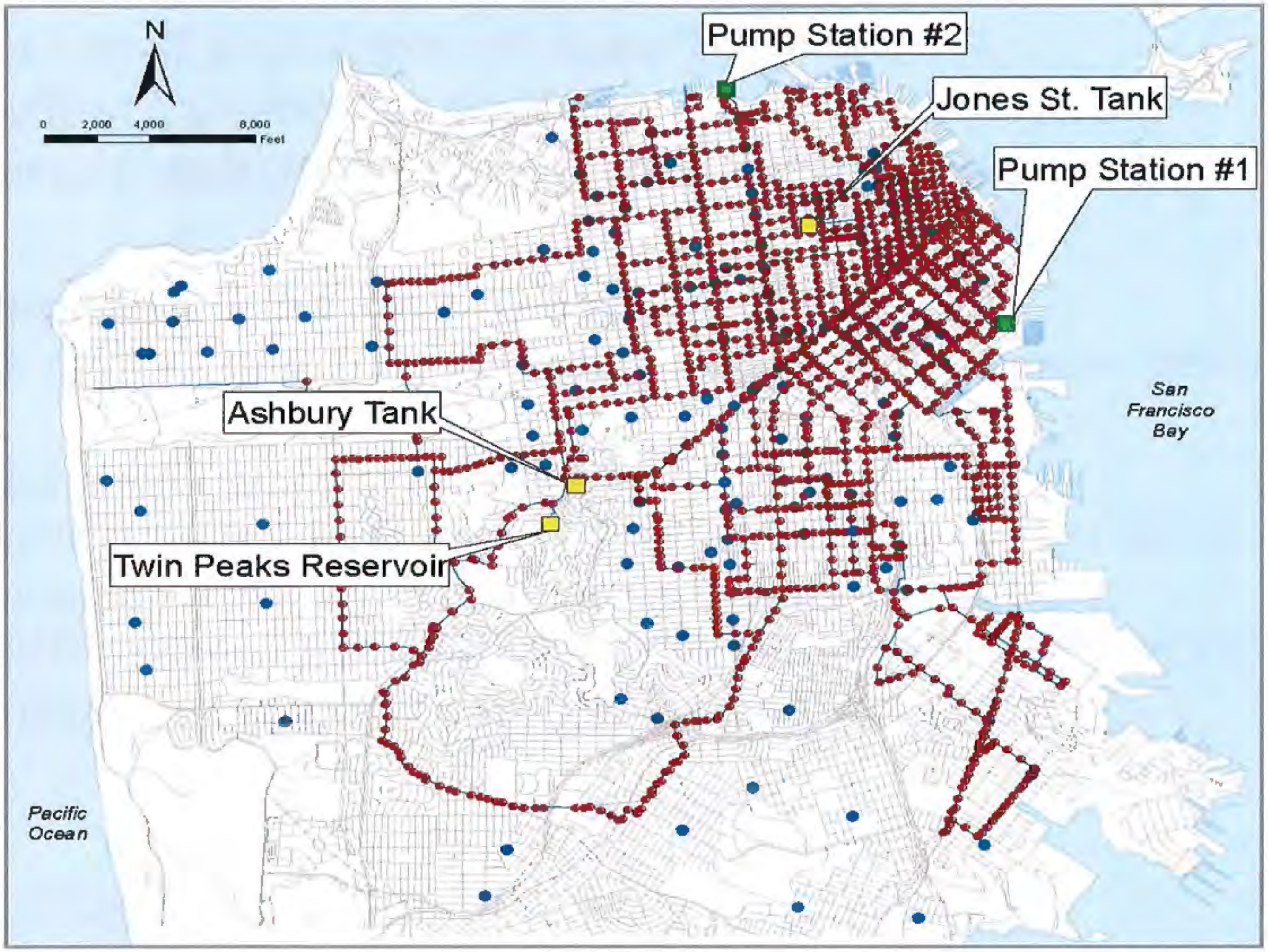
- Emergency Firefighting Water System (EFWS): A high-pressure fire-suppression water system built after 1906 earthquake
- Ownership transferred to SFPUC in 2010
- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works
- Hydraulic Modeling utilized to guide decision making.

Water Power Sewer

ONESF Building Our Future

Original EFWS Map

33 Seismically Reliable Valves Throughout System



Partnership

- Evaluation of EFWS when transferred to SFPUC:
  - Using modern seismic resilience capability analysis looking for vulnerabilities, leading to immediate and future projects
  - 47% system reliability for median flow of water needed by SFFD to fight fires after 7.8 earthquake
- Since 2010 - SFPUC, SFFD, and Public Works have been implementing projects to improve the EFWS.
- Projects completed utilizing Earthquake Safety and Emergency Response Bonds:
  - 2010 Bond: $102 million for EFWS capital projects
  - 2014 Bond: $54 million for EFWS capital projects

Water Power Sewer

ONESF
Building Our Future

Key ESER Projects Completed

- EFWS Reliability upgrades at three primary source supplies:
  - Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank
- Replaced engines and installed remote control capabilities for Seawater pump station #1
- Installation of 30 new cisterns:
  - 15 in the Sunset and Richmond districts
- Electronic Control Improvements
- 6 pipeline and tunnel projects

Key ESER Projects Underway

- Seawater pump station #2
- 19th Ave. Pipeline:
  - Bidding Feb 2020
- Ashbury Bypass Pipeline
- Clarendon Supply Pipeline
- Irving St. Pipeline
- Terry Francois Blvd. Pipeline:
  - Phase 1: completed
  - Phase 2: Bidding 2019

Water Power Sewer

ONESF
Building Our Future

Development Projects

- Large Development Projects install EFWS pipes within their development boundaries.
- SFFD & SFPUC negotiate with Developers for projects outside of the development boundaries.

- **Mission Rock**
- **Mission Bay**
- **Pier 70**
- **Potrero Powerplant**
- **Potrero Hope SF**
- **Sunnydale Hope SF**
- **Park Merced**
- **Candlestick**
- **Hunters Point/Shipyard**
- **Executive Park**
- **Visitation Valley**
- **India Basin**

San Francisco Water Power Sewer

ONESF Building Our Future

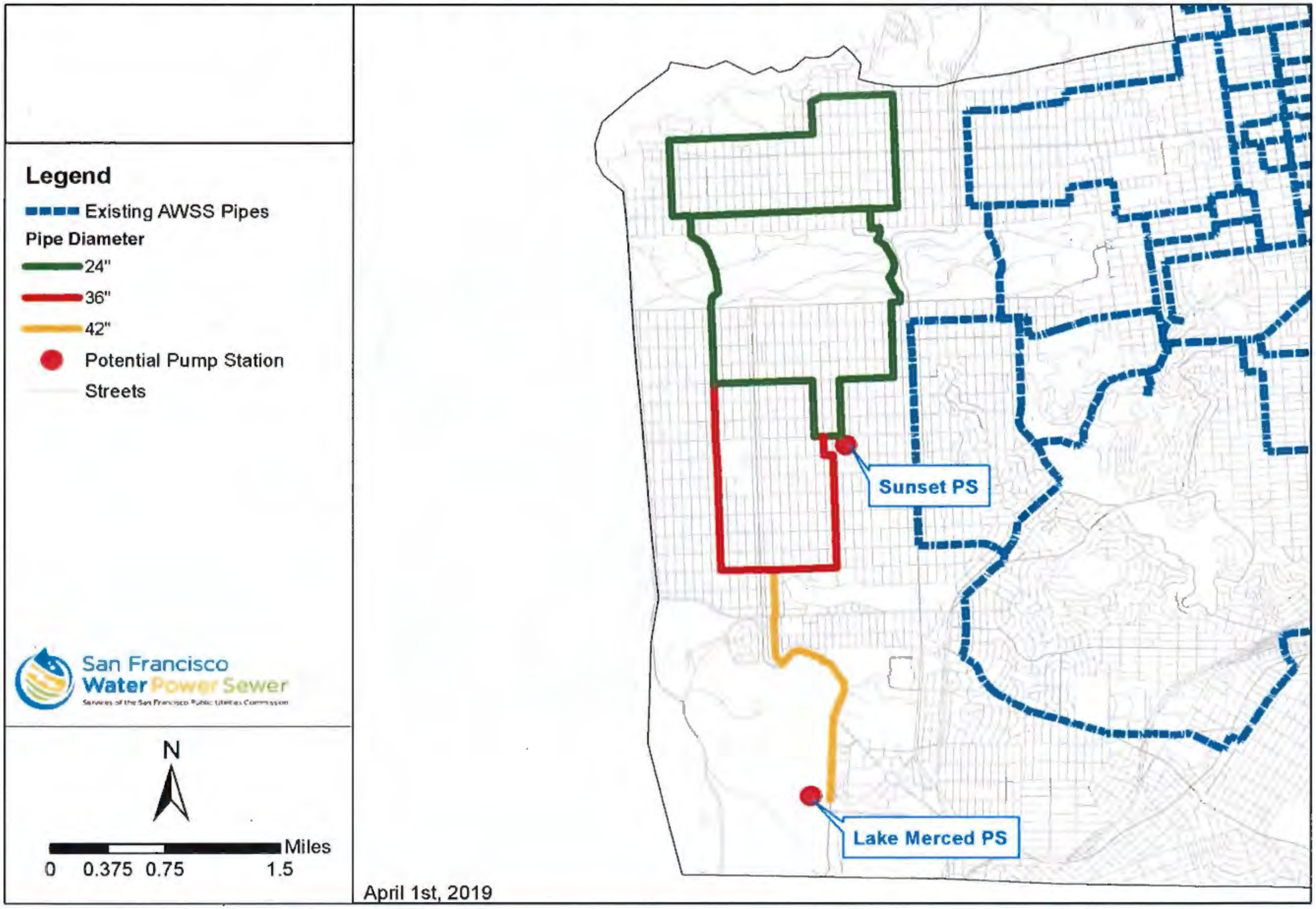
Preliminary List of Potential Projects

- Developed a preliminary list of potential projects that SFPUC and SFFD continue to develop and analyze

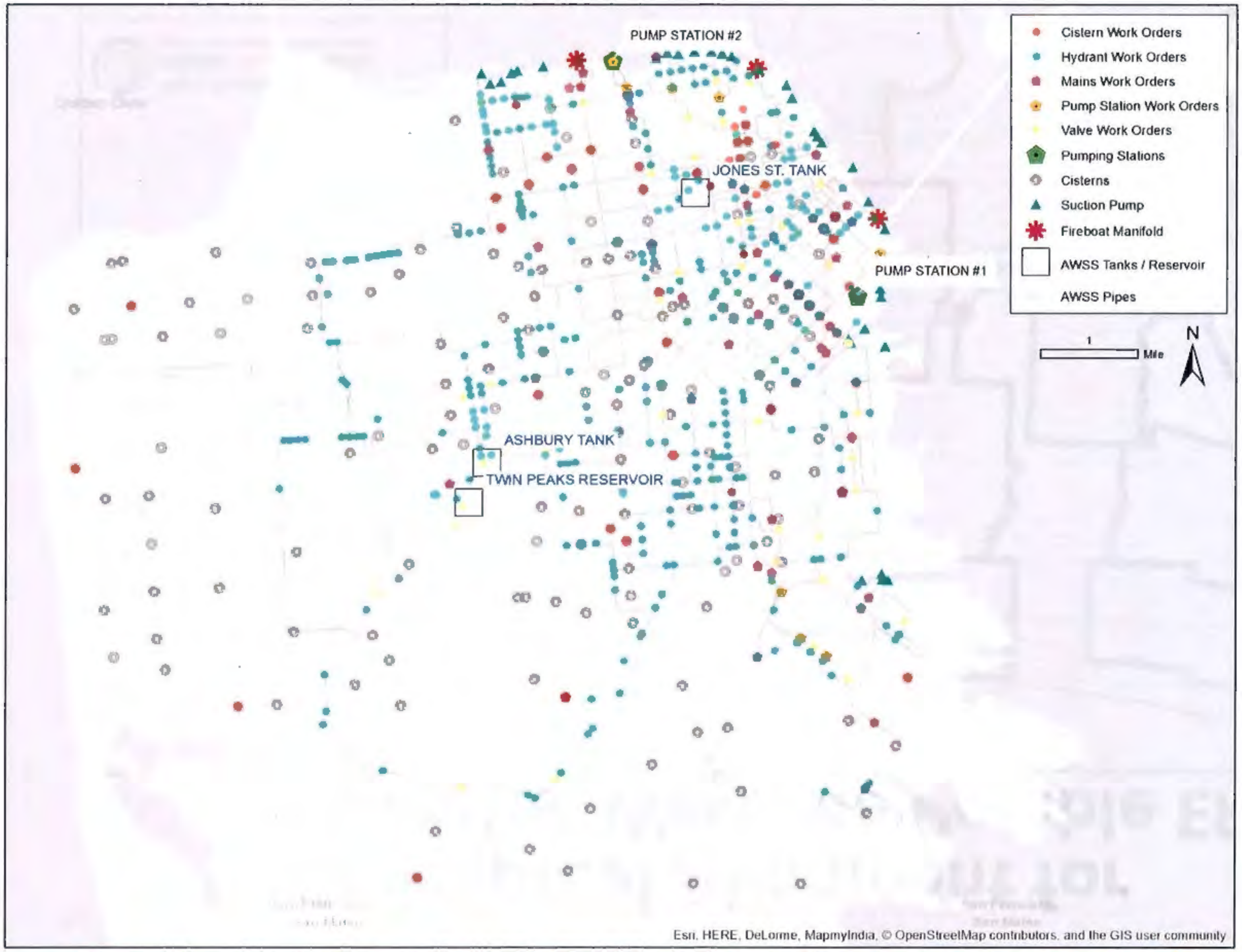
- Preliminary projects range in scope:
  - Pipeline projects
  - New water sources
  - Infirm area projects

- Citywide with a focus in areas that have limited access to the EFWS

Conceptual Alignment for Potential Westside Potable EFWS



Maintenance Activities



San Francisco Water Power Sewer

ONESF Building Our Future

Moving Forward

- Continue to implement EFWS projects using remaining 2014 ESER Bonds: ***estimated completion end of 2021***

- Continue to perform routine and high-quality maintenance on the EFWS to ensure it is in good working order: ***ongoing***

- 5 Hose Tenders in FY19-20 Budget (4 in City Budget, 1 from State)

- Continue to conduct regular emergency response trainings with all applicable City agencies, while also working collaboratively to enhance the scope and frequency of trainings: ***ongoing***

- Memorialize a detailed roadmap for annual emergency response exercises in SFFD-SFPUC Memorandum of Understanding: ***6/30/2020***

San Francisco Water Power Sewer

ONESF Building Our Future

Moving Forward Cont'd.

- SFPUC and SFFD complete seawater pump station study: ***6/30/2021***

- SFPUC to continue efforts to complete more detailed analysis of emergency firefighting water needs within neighborhoods: ***6/30/2021***

- Develop a robust and thorough plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 7.8 earthquake: ***12/31/2021***

- Quarterly presentations to SFPUC Citizen Advisory Committee and increased community meetings: ***ongoing***

Water Power Sewer

ONESF Building Our Future

EFWS in the Capital Plan

- Recent Funding
  - ESER 2010: $102.4 million
  - ESER 2014: $54.1 million
- FY2020-29 Capital Plan
  - ESER 2020: $153.5 million
  - SFPUC Funds
  - Future ESER Funds

San Francisco Water Power Sewer

ONESF
Building Our Future

Thank you

San Francisco Water Power Sewer

ONESF
Building Our Future

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

DATE: September 16, 2019

TO: Members of the Board of Supervisors

FROM: AC Angela Calvillo, Clerk of the Board

SUBJECT: 2018-2019 Civil Grand Jury report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

We are in receipt of the following required responses to the San Francisco Civil Grand Jury report released July 17, 2019, entitled: "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System." Pursuant to California Penal Code, Sections 933 and 933.05, named City Departments shall respond to the report within 60 days of receipt, or no later than September 15, 2019.

For each finding the Department response shall:

1) agree with the finding; or
2) disagree with it, wholly or partially, and explain why.

As to each recommendation the Department shall report that:

1) the recommendation has been implemented, with a summary explanation; or
2) the recommendation has not been implemented but will be within a set timeframe as provided; or
3) the recommendation requires further analysis. The officer or agency head must define what additional study is needed. The Grand Jury expects a progress report within six months; or
4) the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

The Civil Grand Jury Report identified the following City Departments to submit responses (attached):

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;

Continues on next page

- Fire Department:
  Received September 16, 2019; and
- City Administrator:
  Received September 16, 2019.
- Department of the Environment
  Received September 16, 2019.

These departmental responses are being provided for your information, as received, and may not conform to the parameters stated in California Penal Code, Section 933.05 et seq. The Government Audit and Oversight Committee will consider the subject report, along with the responses, at a hearing on September 19, 2019.

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	**F#**	**Finding** (text may be duplicated due to spanning and multiple respondent effects)	**Respondent Assigned by CGJ [Response Due Date]**	**Finding Response** (Agree/Disagree)	**Finding Response Text**	**R# [for F#]**	**Recommendation** (text may be duplicated due to spanning and multiple respondent effects)	**Respondent Assigned by CGJ [Response Due Date]**	**Recommendation Response** (Implementation)	**Recommendation Response Text**
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	San Francisco Public Utilities Commission Response (by the Commission President) to the 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:14:02 AM
Attachments:	President Caen Letter to CGJ.pdf

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Wednesday, September 11, 2019 11:11 AM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

From: Hood, Donna
Sent: Wednesday, September 11, 2019 11:10:54 AM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Kelly Jr, Harlan; Breed, London (MYR)
Subject: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

Good Morning,

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*.

Thank you,

Donna Hood
Commission Secretary
San Francisco Water, Power and Sewer/Services of the San Francisco Public Utilities Commission
525 Golden Gate Ave., 13th Floor
San Francisco, CA 94102
415-554-0761 (direct)
http://sfwater.org/

Conserve a drop today for a drink tomorrow! Learn how at www.sfwater.org/conservation

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **19-0178**

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The “reliability scores” being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O’Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city’s population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD’s potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.					

From: Anatolia Lubos
To: Carroll, John (BOS)
Subject: Fire Commission Response to 2018-2019 AWSS Report
Date: Friday, September 13, 2019 10:03:24 AM
Attachments: Copy of Fire Commission_Nakajo_AWSS Matrix of Findings and Recommendations Response 190904.xlsx

---

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Thursday, September 12, 2019 1:24 PM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Civil Grand Jury Report

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 1:24:22 PM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Rasha Harvey; Steve Nakajo (sknakajo@yahoo.com); Nicholson, Jeanine (FIR)
Subject: RE: Civil Grand Jury Report

Here's the correct document.

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 11:45 AM
To: CGrandJury@sftc.org
Cc: Rasha Harvey <r.harvey@sfcgj.org>; Steve Nakajo (sknakajo@yahoo.com) <sknakajo@yahoo.com>; Nicholson, Jeanine (FIR) <jeanine.nicholson@sfgov.org>
Subject: Civil Grand Jury Report

Dear Honorable Garrett L. Wong,

Please see attachments.   I will also send by U.S. Mail.

Sincerely,

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

CITY AND COUNTY OF SAN FRANCISCO

2018-2019 CIVIL GRAND JURY

MEMORANDUM

TO: Mayor and Members of the Board of Supervisors

CC: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Anatolia Lubos, Grand Jury Administrative Analyst

DATE: July 18, 2019

SUBJECT: Civil Grand Jury Report, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

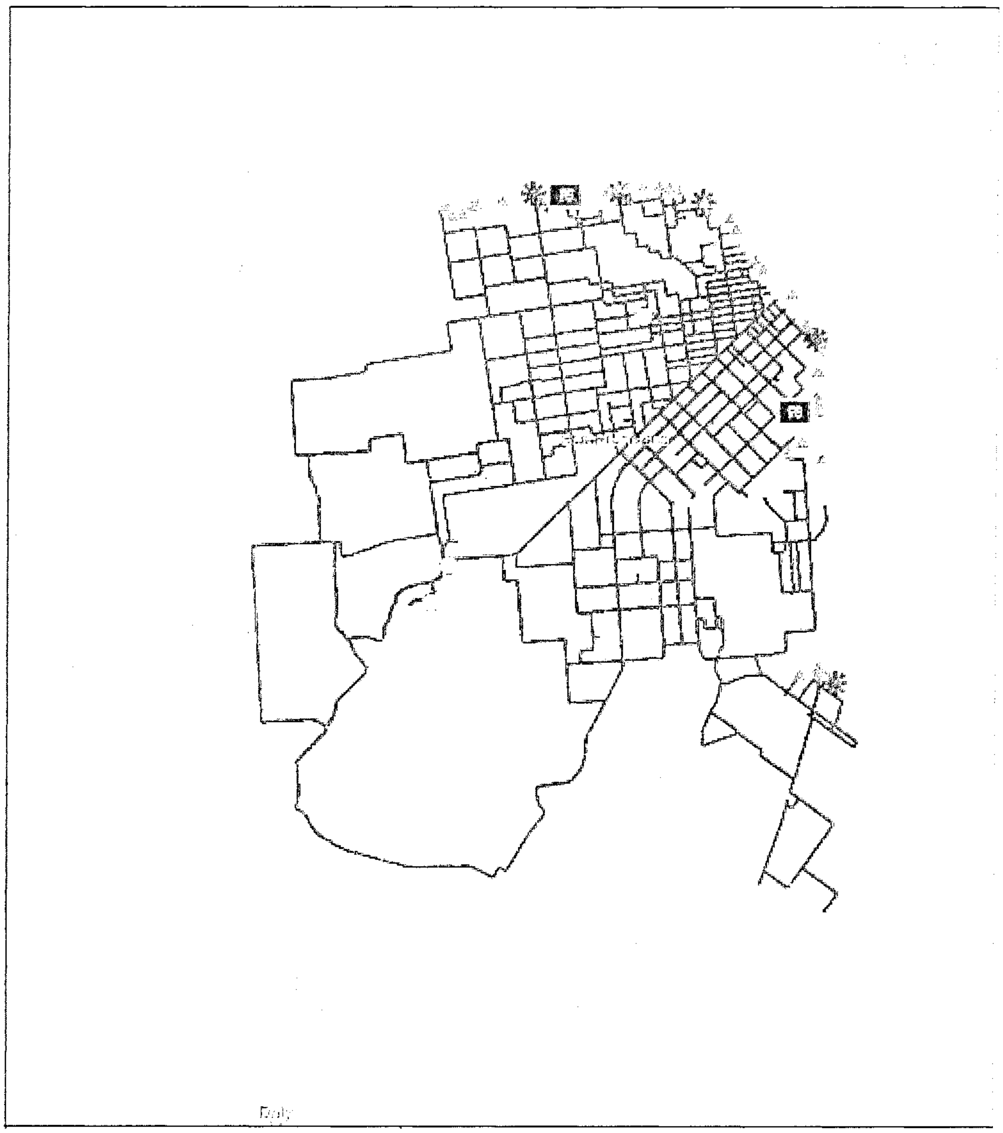
The previous version of the aforementioned Civil Grand Jury report as received and distributed on Monday, July 15, 2019 was incomplete and omitted Appendices F to R (inclusive).

Enclosed is the complete report.

400 MCALLISTER STREET, ROOM 008, SAN FRANCISCO, CA 94102
PHONE: 415-551-3635

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR HIGH-PRESSURE EMERGENCY FIREFIGHTING WATER SYSTEM



City and County of San Francisco
2018-2019 Civil Grand Jury

THE CIVIL GRAND JURY AND ITS OPERATIONS

California state law requires that all 58 counties impanel a Grand Jury to serve during each fiscal year. *California Penal Code Section 905; California Constitution, Article I, Section 23*

The Civil Grand Jury investigates and reports on one or more aspects of the County's departments, operations, or functions. *California Penal Code Sections 925, 933(a)*

Reports of the Civil Grand Jury do not identify individuals interviewed by name. *California Penal Code Section 929*

The Civil Grand Jury issues reports with findings and recommendations resulting from its investigations to the Presiding Judge of the Superior Court. *California Penal Code Section 933(a)*

Each published report includes a list of those elected officials or departments that are required to respond to the Presiding Judge of the Superior Court within 60 or 90 days as specified. *California Penal Code Section 933*

California Penal Code Section 933.05 is very specific with respect to the content of the required responses. Under Section 933.05(a), for each finding, the response must:

1) Agree with the finding, or
2) Disagree with it, wholly or partially, and explain why.

Similarly, under Penal Code Section 933.05(b), for each recommendation, the responding party must report that:

1) The recommendation has been implemented, with a summary of the implemented action; or
2) The recommendation has not been implemented but will be within a set timeframe; or
3) The recommendation requires further analysis, with an explanation of what additional study is needed, and the timeframe for conducting that additional study and the preparation of suitable material for discussion. This timeframe may not exceed six months from the date of publication of the Civil Grand Jury's report; or
4) The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Any San Francisco resident who is a US citizen and is interested in volunteering to serve on the Civil Grand Jury for the City and County of San Francisco is urged to apply. Additional information about the San Francisco Civil Grand Jury, including past reports, can be found online at http://civilgrandjury.sfgov.org/index.html .

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

MEMBERSHIP ROSTER

RASHA HARVEY (Foreperson)

JANET ANDREWS HOWES (Parliamentarian)

LINDA BADGER

ANDREW BENJAMIN

GORDON CRESPO

KRISTINE EQUIHUA (Technology Secretary)

STEPHEN GARBER

JONATHAN HILL

LEONARD KULLY (Correspondence Secretary)

WILLIAM LEE (Foreperson Pro Tem)

FRANK NETTLETON

NONA RUSSELL

RANDALL SMITH (Recording Secretary)

KAAREN STRAUCH BROWN

RUSH STURGES

MARTHA SUTHERLIN

JASON TAM

MICHAEL WIXTED

EXECUTIVE SUMMARY

San Francisco is one of the most vulnerable cities in the world, and certainly in the United States, to the risk of fire following an earthquake. In 1906, the City suffered tremendous destruction and devastation from the fires that followed a major earthquake. Over 3,000 people died and approximately 28,000 buildings were destroyed. In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage. We know the question is when, not if, another major earthquake will strike San Francisco and ignite numerous fires.

The Civil Grand Jury believes it is essential that we take prompt and aggressive action to expand and enhance our defenses against the inevitable fires following an earthquake before it is too late. All parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – deserve to be well protected against this catastrophic risk.

Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system (MWSS) -- that provides excellent firefighting protection to parts of the City. However, large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS and are not nearly as well protected.

Plans to develop a seismically safe high-pressure AWSS for the western portions of our City are now moving forward. But even though City leaders have known about this issue for decades, the City still does not have concrete plans or a timeline to provide a more robust emergency firefighting water supply for all parts of the City that need one.

In 2014, the U.S. Geological Survey (USGS) estimated there is a 72 percent chance of one or more magnitude 6.7 or greater earthquakes striking the Bay Area between 2014 and 2043. Earlier this year Mayor London Breed announced that planning for such a disaster is a priority. But at our current pace and funding levels, expansion of a high-pressure AWSS to currently unserved parts of the City will not be completed for another thirty-five (35) years or more–well after the USGS predicts we will be struck by one or more major earthquakes.

The Civil Grand Jury makes the following recommendations, among others which are more fully discussed herein:

- The City should be prepared to fight fires in all parts of the City in the event of a repeat of a 1906 size earthquake;
- The City should aggressively develop a high-pressure, multi-sourced, seismically safe emergency water supply for those parts of the City that don't currently have one, with a target completion date of no later than 2034;
- As an interim measure, the City should immediately replace and expand its inventory of Portable Water Supply System (PWSS) hose tenders, which are comparatively cheap, can be acquired much more quickly than the high-pressure AWSS, and were essential in fighting the 1989 Loma Prieta fire, but are now past their useful life;
- The new PWSS hose tenders should be strategically placed in those areas of the City that do not have a high-pressure, multi-sourced, seismically safe emergency water supply.

TABLE OF CONTENTS

List of Figures **Page No.**

List of Tables **Page No.**

BACKGROUND AND PROBLEM STATEMENT

No one knows when the next large earthquake is coming. But it is coming.

A. Fire Following Earthquake Is a Major Risk to The City

"San Francisco will sustain major damage from fires following future earthquakes, in addition to the damage caused by shaking."[1] As explained in a 2010 report prepared for the City,

> In San Francisco, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo.[2]

A main reason the 1906 fire was so devastating is that the earthquake destroyed much of the water system.[3]

Fires following earthquakes remain a major threat today. In 1994, approximately 110 fires were ignited after the Northridge earthquake in Los Angeles County, even though it was "only" a 6.7-magnitude earthquake.[4] In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage.[5] In Kobe "broken water

---

[1] Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010) ("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[2] *Id.*; footnote omitted.

[3] See Scawthorn, C., O'Rourke, T. D. & Blackburn, F., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*, Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; see also Scawthorn, C., Water Supply In Regard to Fire Following Earthquake, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 5.

[4] See discussion in Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 7; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 12-17.

[5] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 17-19; ATC, 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

mains left the fire department helpless, and fires destroyed more than 7,000 buildings."[6] A magnitude 7.9 earthquake would be an estimated 10 times larger than a magnitude 6.9 earthquake, and would release approximately 31 times more energy.[7]

San Francisco is by far the most densely populated large city in California and is the second most densely populated large city in the country.[8] With mostly wood construction in many areas, this dense City remains at significant risk.[9]

B. AWSS Background and Current Status

After the 1906 earthquake and its devastating fires, the City built an independent emergency water supply for firefighting, known as the AWSS.[10]

The AWSS is a separate, non-potable emergency firefighting water supply system that at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations.[11] Applying a "belt

---

[6] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[7] See the United States Geological Survey's "How Much Bigger ....?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can compare the relative size and strength of different magnitude earthquakes.

[8] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 6.

[9] Ibid.

[10] See generally SFPUC, Frequently Asked Questions–Fire Suppression Water Systems, dated November 2017 "SFPUC 2017 FAQ", https://sfwater.org/modules/showdocument.aspx?documentid=11507 attached as Appendix N; see also Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf

[11] AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report), February2014 ("CS-199"), at p. 7, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; SFPUC Fact Sheet, dated Summer 2012, located at https://www.sfwater.org/modules/showdocument.aspx?documentid=2501 and printed March 6, 2019. The online Fact Sheet is outdated, as the City has added approximately 30 more cisterns through the 2010 and 2014 ESER bonds. The SFFD also has three large capacity fireboats berthed at Pier 22 ½ and an additional, smaller fireboat berthed at the San Francisco Marina Yacht Harbor.

People sometimes confuse Emergency Firefighting Water System (EFWS) and AWSS, or use them interchangeably. EFWS is the broader concept, including all emergency sources of water and the means for delivering them. AWSS is sometimes described as including cisterns, and other times not. Compare CS-199, at p. 7, ("AWSS is a water supply system consisting of pipelines, cisterns, reservoir, storage tanks, and salt-water pump stations.") https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 with AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report, January 5, 2018 ("2018 Westside Options Analysis"), at pp. 10-13, 20 (differentiating between EFWS and AWSS, and discussing cisterns as a supplement to but not part of AWSS), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

and suspenders" approach, if the City's MWSS mains break leaving low-pressure hydrants useless, firefighters will have access to other sources of water, including the Twin Peaks Reservoir and the Bay. Unlike the MWSS, AWSS pipelines were designed to withstand movement from an earthquake.[12]

The AWSS is "remarkably well designed to furnish large amounts of water for firefighting purposes under normal conditions and contains many special features to increase reliability in the event of an earthquake."[13] The AWSS is "designed to provide water at higher pressures than the potable water system, allowing firefighters to use water from the AWSS hydrants without requiring a fire engine."[14]

Another of the key features of the AWSS is its redundancy. The HP AWSS was designed with both a redundant water supply and a gridded main system.[15] This feature provides a more reliable emergency water supply system, allowing potential pipe breaks to be bypassed.[16] As succinctly stated by an outside expert, "the AWSS achieves high reliability by having multiple sources, a highly redundant network and special piping and valves."[17]

The AWSS was originally built over 100 years ago, at a time when the northeast portion of the City contained both the central business district and the majority of the City's population.[18] As a result, the multi-sourced, HP AWSS pipeline network primarily covers just the northeastern part of the City.[19]

The City has been considering expanding the HP AWSS for decades. For example the Analysis by the Ballot Simplification Committee of 1986's Proposition A, Fire Protection Bonds, specifically noted that parts of the City were not served by the HP AWSS:

This report will use EFWS as the broader concept, and will generally use AWSS to refer to the HP AWSS (the 135 miles of pipelines and associated facilities but not including cisterns), although we will not change quotes. This distinction is important, as there are cisterns in the southern and western portions of the City, but not the HP AWSS.

[12] CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[13] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf,, at p. 80; see also Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp.12-15.

[14] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[15] *Id.*, at p. 37.

[16] Ibid.

[17] C. Scawthorn, January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis" "Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 .

[18] See SFPUC 2017 FAQ, Question 2, at https://sfwater.org/modules/showdocument.aspx?documentid=11507 , a copy of which is attached as Appendix N.

[19] *Id.*

> THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.[20]

In June 2003, the 2002-2003 Civil Grand Jury recommended that the HP AWSS be extended "to serve all parts of the City."[21] Yet three decades after the 1986 bond and 16 years after the prior Civil Grand Jury report, many neighborhoods still do not have HP AWSS pipelines.[22] Plans are moving forward to fund a new HP AWSS using potable water on the west side through an upcoming Earthquake Safety and Emergency Response Bond (ESER) issuance, but at the City's current pace it will take approximately 35 years or more to build out a HP AWSS pipeline system that serves all neighborhoods, including the southern portions of the City.[23] The City does not have a plan with a firm timeline for completion of this work or firm plans to fund all the work that needs to be done.

C. Problem Statement

Certain parts of the City, such as the northeast quadrant, are well protected against the risk of fires following an earthquake. These well-protected areas have a multi-sourced, redundant, Emergency Firefighting Water System (EFWS), including the HP AWSS. Unfortunately, other parts of the City are protected only by the low-pressure MWSS and by cisterns, which are not

---

[20] The 1986 Ballot Simplification Committee Analysis explained the proposal for Proposition A as paying for improvements including extending the high-pressure system and installing a high-pressure pump station at Lake Merced. Proposition A passed, but large areas of the City still do not have the protection of the independent high-pressure water system, and Lake Merced still does not have a high-pressure pump station. A copy of the Analysis by the Ballot Simplification Committee of the 1986 Proposition A is attached as Appendix L.

[21] 2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf, at p. 2.

[22] Neighborhoods currently without HP AWSS hydrants include Bayview Heights, Crocker Amazon, Excelsior, Ingleside, Merced Manor/Parkside, Mission Terrace, Oceanview, Outer Mission, Outer Richmond, Outer Sunset, Portola, Sea Cliff, Stonestown, and Sunnyside. A map showing the current layout of HP AWSS pipelines is on the cover and is attached as Appendix I.

[23] March 4, 2019 and March 11, 2019 SFPUC presentations and accompanying materials provided to the Emergency Firefighting Water System Management Oversight Committee. The amount of funding potentially available through the 2020 ESER bond and through water rates has been increased since the March 2019 Emergency Firefighting Water System Management Oversight Committee meetings. Thus, it *may* now be somewhat less than the 35 years presented in March. It has been difficult to tie down the City's "pace of funding" given there are no firm long term plans and the amount of funding available through an ESER bond can and does change. Although 35 years may be off somewhat, it remains the best (indeed only) current articulation of pace of funding and a timeline provided to the Civil Grand Jury.

nearly as reliable for fighting fires following a major earthquake and, unlike the HP AWSS, need fire engine support to effectively deliver water to a fire.[24]

The problem addressed in this report is how to ensure that all parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – are well protected from fires following earthquakes before it is too late.

METHODOLOGY

Members of the Civil Grand Jury conducted interviews with representatives of:

- The San Francisco Public Utilities Commission
- The San Francisco Fire Department
- The San Francisco Department of Public Works
- The San Francisco Office of Resilience and Capital Planning
- The San Francisco Department of the Environment
- The San Francisco Fire Commission
- The Board of Supervisors

Members of the Civil Grand Jury also conducted interviews with:

- Retired members of the San Francisco Fire Department
- A retired fire chief from a local jurisdiction
- Technical experts in the fields of engineering, wildfires, and water supply for fighting fires after earthquakes
- Concerned community members

Members of the Civil Grand Jury reviewed numerous planning and engineering reports specifically focusing on the AWSS or the PWSS, listed in Appendix D.

Members of the Civil Grand Jury also reviewed the relevant parts of articles, publications and reports regarding fires following earthquakes and related issues. These more general sources, some of which discuss the AWSS or PWSS but are not solely focused on them, are listed in Appendix E. [25]

---

[24] See discussion of expected problems of relying on a municipal water supply system in Section D of the Discussion, at pp. 18-20.

[25] Several of these publications are technical papers, and the Civil Grand Jury is comprised of lay citizens. When we cite or refer to technical papers it is generally for the conclusions or other non-technical information; we do not purport to be knowledgeable regarding the intricacies of fire spread models or the like.

DISCUSSION

Succinctly stated, "water supply is critical to firefighting."[26] Without a reliable water supply, the San Francisco Fire Department (SFFD) cannot be realistically expected to fight fires following a major disaster such as an earthquake.

A. San Francisco is Highly Vulnerable to Fires Following a Major Earthquake

San Francisco is highly vulnerable to fire after an earthquake, more than any other city in the country.

As explained in a 2008 article for the International Association for Fire Safety Science,

> Densely built environments are highly vulnerable to disasters. Common problems include: (a) narrow streets enabling fire to spread easily from one building to another; (b) streets cluttered with collapsed buildings in an earthquake restricting fire engine access; (c) shortage of open spaces which function as fire breaks or evacuation sites; (d) older and less robust wooden houses that easily collapse and burn in an earthquake ....[27]

San Francisco has significantly higher population density than any other county in California, as shown in Figure 1 on the next page: [28]

---

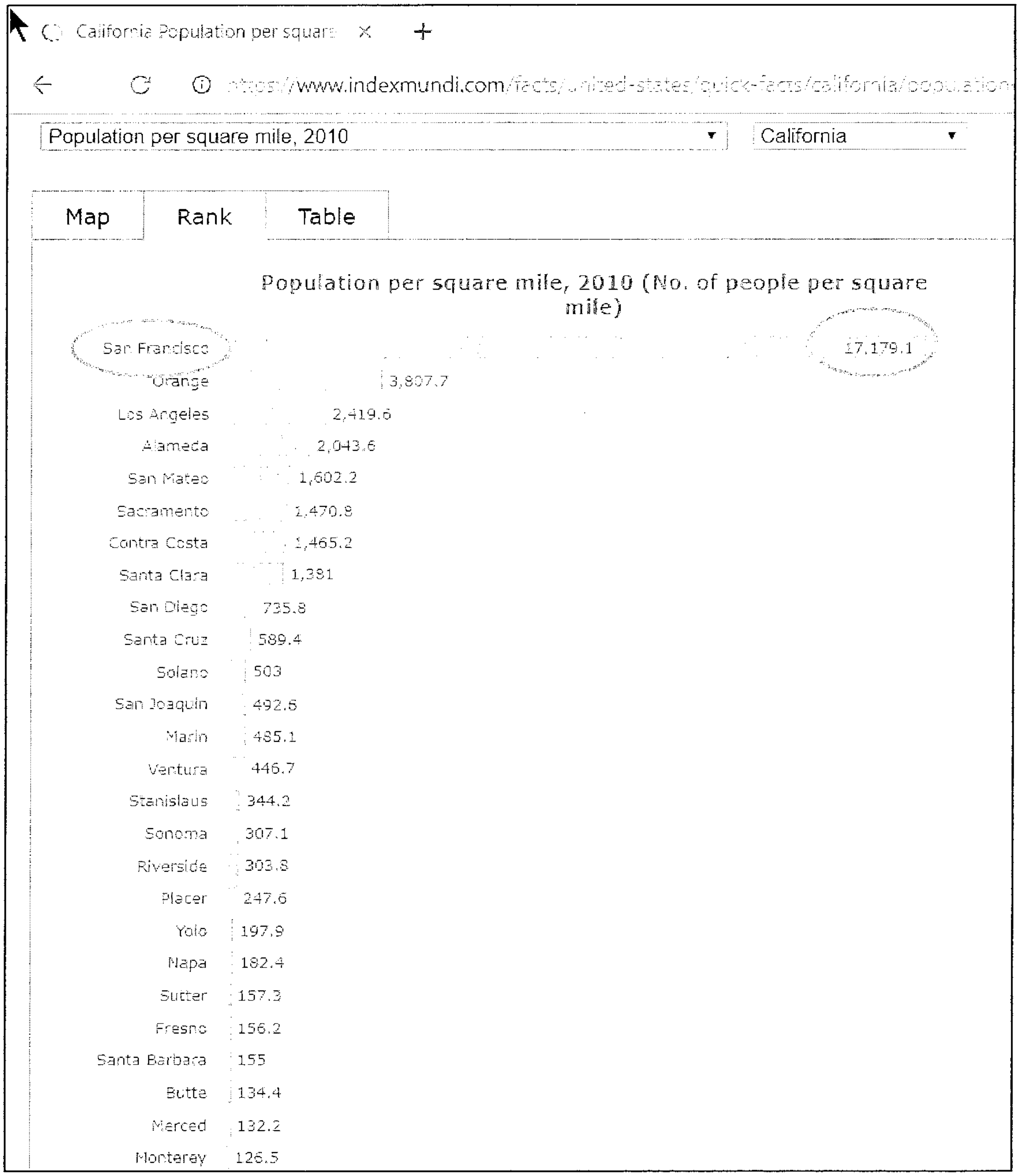
[26] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 12.

[27] Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf. at pp. 267-268 (parenthetical reference omitted). San Francisco does have streets that operate as fire breaks: Market St., Van Ness Ave., Geary St. (west of Gough), Dolores St., Mission St, 19th Avenue, Park Presidio Blvd., Alemany Blvd., and Third Street.

[28] See https://www.indexmundi.com/facts/united-states/quick-facts/california/population-density#chart .

Figure 1

Population Density By County



Similarly, based on 2016 data, San Francisco is the eighth densest city in the country with a population above 50,000, and other than New York City is the densest city with a population above 100,000:[29] See Figure 2, below.

Figure 2

Population Density by City

https://www.governing.com/gov-data/population-density-land-area-cities-map.html

Maps & Data - Geography - U.S. Census Bureau

- Passaic, N.J.: 22,424 persons/sq. mile

The following table lists population densities for U.S. cities with populations of at least 50,000 as of 2016:

Search:

City	Population Density (Persons/Square Mile)	2016 Population	Land Area (Square Miles)
Union City, New Jersey	54,138	69,296	1
West New York, New Jersey	52,815	53,343	1
Hoboken, New Jersey	42,484	54,379	1
New York, New York	28,211	8,537,673	303
Passaic, New Jersey	22,424	70,635	3
Somerville, Massachusetts	19,738	81,322	4
Huntington Park, California	19,561	58,879	3
San Francisco, California	18,581	870,887	47
Jersey City, New Jersey	17,860	264,152	15
Paterson, New Jersey	17,438	147,000	8
Cambridge, Massachusetts	17,316	110,651	6
East Orange, New Jersey	16,528	64,789	4

San Francisco also has many narrow streets, and buildings that will almost certainly collapse in an earthquake and obstruct many streets, blocking traffic including fire engines. We also have a heavy concentration of older, wooden homes that are densely concentrated and highly flammable.[30]

[29] https://www.governing.com/gov-data/population-density-land-area-cities-map.html.

[30] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

This is not just the Civil Grand Jury's perspective. Many experts, and numerous witnesses interviewed by the Civil Grand Jury, have opined that San Francisco faces "the most serious conflagration risk" and "will sustain major damage from fires following future earthquakes…."[31]

In July 2010, SPA Risk LLC (Dr. Charles Scawthorn, principal) prepared a report entitled, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, for the Applied Technology Council (ATC) on behalf of the City's Department of Building Inspection.[32] The report concluded that San Francisco is at "significant risk" due to fire following earthquake, and that the SFFD's fire engines[33] "will almost certainly not be able to respond to all post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for a magnitude 7.9 San Andreas event."[34]

A key table in that 2010 report is copied below:

Table 1

Bounds for Losses to Buildings Due to Fire Following Earthquake[35]

	25% - 75% Confidence Range		
	Ignitions	Loss $ billions	Total Burnt Building Floor Area Mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

31 See, e.g., Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf, at p. iii ("Scawthorn 1987"); ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at pp. vi, 25-29.

32 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf.

33 SFFD now has 44 frontline fire engines, and 19 relief engines, according to information provided by the SFFD. At the time of the 2010 report, the City apparently had 42 frontline engines.

34 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2. A copy of the Abstract (or summary) of that report is attached as Appendix K.

35 Ibid. These estimates already take into account the AWSS system as it existed in 2010 (i.e., prior to the addition of more cisterns and other work performed under the 2010 and 2014 ESER bonds). The damage estimates do not include business interruption losses, loss of tourism or loss of property tax revenues.

As explained in that report, there is significant uncertainty regarding how many fires might be ignited following an earthquake, and the extent of damage they are likely to cause. One of the key variables is completely outside the City's control: wind. In 1989, the City was extremely lucky that there was no wind.[36] Indeed, "stronger wind conditions would have resulted in much greater fire spread in the Marina...."[37]

According to the 2010 report, there is a 25% chance that fires and damages could fall below the ranges in Table 1 on the preceding page, and an equal likelihood that they could exceed the ranges in that table.[38] Earlier this year (2019) the San Francisco Public Utilities Commission (SFPUC) engaged Dr. Scawthorn to update his analysis, but that update will not be completed until after this report has been issued. However, the key is not the precise numbers but "their overall magnitude."[39] Indeed, given the escalation in Bay Area home values over the last decade, one can only assume that the dollar loss estimates will increase substantially.

B. The USGS Warns the San Francisco Bay Area Has a High Likelihood of a Major Earthquake

In 2014, the USGS estimated there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043.[40] This was based on a new model, commonly referred to as the third Uniform California Earthquake Rupture Forecast, or UCERF3.[41]

Small earthquakes occur more frequently than large earthquakes.[42] According to the updated model, the probability that an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent. By comparison, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent for the same area, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent.[43]

---

[36] Scawthorn and Blackburn, Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990.

[37] *Id.*, at p. 6.

[38] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2, attached as Appendix K.

[39] *Ibid.*

[40] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf, attached as Appendix G.

[41] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf, attached as Appendix F.

[42] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf, attached as Appendix G.

[43] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf, attached as Appendix F.

Table 2 below is a simplified version of a table from a USGS fact sheet showing the likelihood of one or more events of varying size for the San Francisco region within the next 30 years based on this new model:[44]

Table 2

San Francisco Region Section of Table from March 2015 USGS Fact Sheet 2015-3009

San Francisco Region		
Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events
5	1.3	100%
6	8.9	98%
6.7	29	72%
7	48	51%
7.5	124	20%
8	825	4%

Although these figures are for the region, and not just the City and County of San Francisco, the predictions are sobering. To put these predictions in perspective, the 1989 Loma Prieta earthquake had a magnitude of 6.9, and, even though the epicenter was approximately 60 miles from San Francisco, it was the largest earthquake to strike the City since 1906.[45] Using the USGS online calculator,[46] a 7.5 magnitude earthquake, which has a 20% chance of happening by 2043, would be almost four times bigger than Loma Prieta, and would release almost eight times the energy. An 8.0 magnitude earthquake would be over 12.5 times bigger than Loma Prieta, and would release almost 45 times the energy. And this is without addressing the risk that the next major earthquake's epicenter could be much closer than 60 miles away.

---

[44] *Id.*, at p.4; Table 2 above is a simplified version of Table 1 of Fact Sheet 2015-3009, attached as Appendix F.

[45] See USGS, M 6.9 October 17, 1989 Loma Prieta Earthquake, https://earthquake.usgs.gov/earthquakes/events/1989lomaprieta/; USGS, M 6.9 - Loma Prieta, California Earthquake, https://earthquake.usgs.gov/earthquakes/eventpage/nc216859/executive.

[46] See USGS, "How Much Bigger ....?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can calculate how much bigger one earthquake is than another.

The USGS has also warned that the pace of large earthquakes is likely to increase:

> In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.[47]

The warnings and predictions from the USGS should be a wake-up call to all of us.

C. The Existing High-pressure AWSS System Only Covers Part of the City

The history and condition of the existing HP AWSS have been described in detail in multiple other reports.[48] Figure 2, on the following page, shows the location of the HP AWSS:[49]

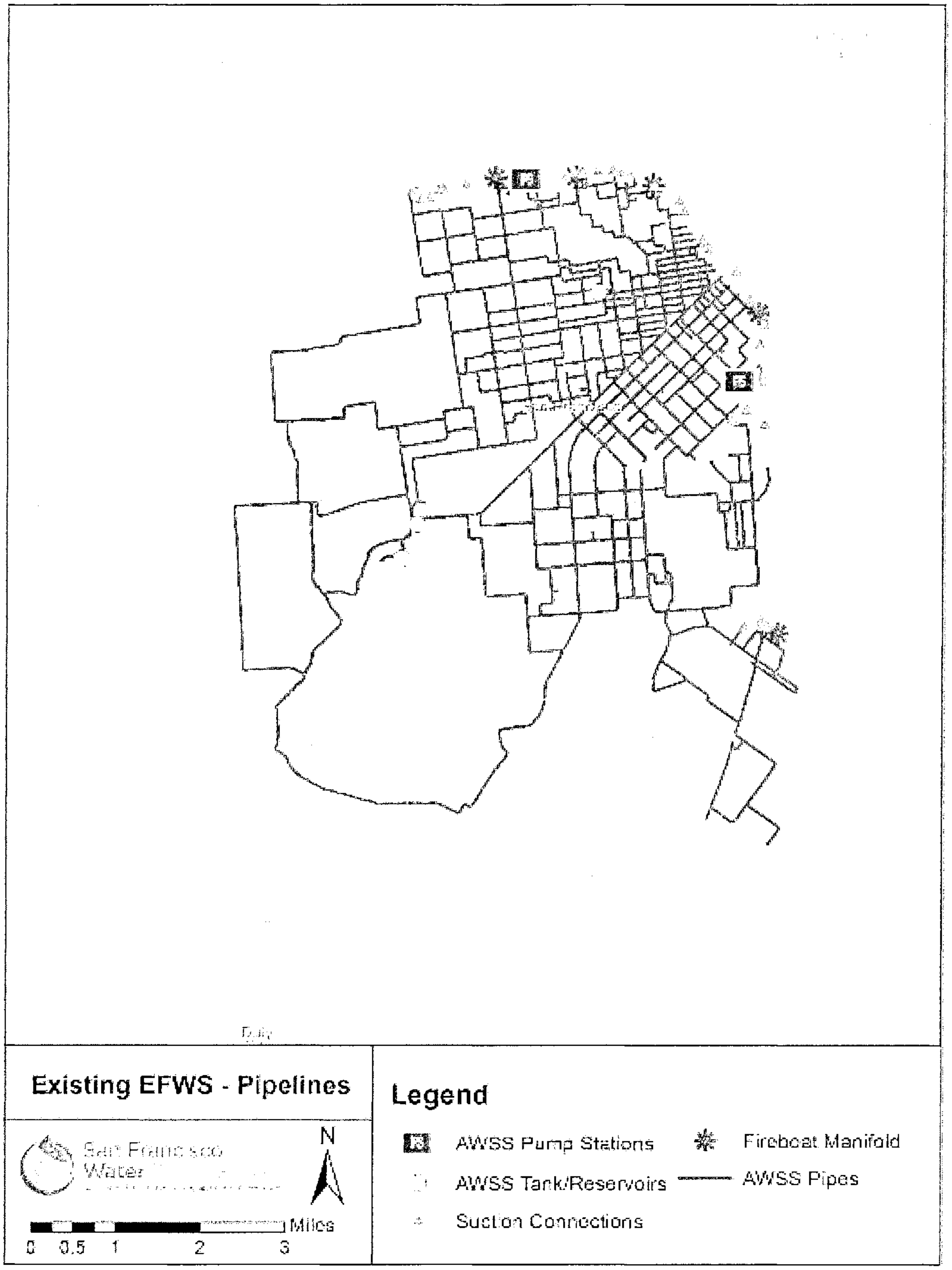
---

[47] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf . See also Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517; *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[48] See, e.g., CS-199, at pp. 7-11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7 .

[49] Map supplied by the SFPUC on May 7, 2019.

Figure 3
Map of Existing High-Pressure AWSS



On a district by district basis, Supervisorial Districts 1, 4, 7 and 11 are not nearly as well protected by the HP AWSS as, for example, Districts 3 or 6:[50] See Table 3 below.

Table 3
HP AWSS Hydrants and Miles of Main by District

Supervisorial District	# of AWSS Fire Hydrants	Miles of AWSS Mains
1	42	5
2	170	14
3	327	23
4	3	0
5	188	16
6	366	27
7	79	7
8	110	9
9	110	9
10	222	18
11	24	1
TOTAL	1641	130

In fact, six of the eleven Supervisorial Districts, Districts 1, 4, 7, 8, 9 and 11, each have less than ten miles of AWSS mains. Districts 1, 4, and 11 each have less than 50 AWSS fire hydrants.

The areas not protected by the HP AWSS would need to rely primarily on getting emergency firefighting water supplies from the City's MWSS through its low-pressure hydrants or from cisterns. For a number of reasons detailed below, these resources are unlikely to provide adequate water to protect residents from fires after a major earthquake.

[50] Data provided by SFPUC on March 13, 2019.

D. The Municipal (Domestic) Water Supply System Is "Highly Vulnerable to Catastrophic Failure"[51]

No one knows with certainty what will happen in a major earthquake. But common sense says we should look at past experience and listen to experts when they warn us not to rely on the MWSS for firefighting following an earthquake.

As explained in a 2009 report prepared for the SFPUC,

> By their nature, domestic water mains are more vulnerable to earthquake damage. Numerous service connections and the jointed construction that is the industry norm contribute to their vulnerability.[52]

San Francisco has made a tremendous effort to improve and seismically reinforce its regional and local water system by means of the $4.8 billion Water System Improvement Project (WSIP).[53] The WSIP is one of the largest water infrastructure programs in the nation and the largest infrastructure program ever undertaken by the City. Among its objectives has been reducing the water system's vulnerability to earthquakes, with a particular emphasis on seismically reinforcing the regional delivery system, transmission mains, and reservoirs.[54]

Although the WSIP greatly enhances the reliability of the MWSS, and in particular the transmission mains and reservoirs, the 2009 report emphasizes that, unlike the HP AWSS, the local MWSS system is vulnerable to a major earthquake due to the numerous branches and service connections that can break and drain the system.[55]

This has been borne out by experience in San Francisco and elsewhere. In the 1906 earthquake, an estimated 23,000 breaks in the MWSS resulted in the loss of water and pressure.[56] In the much smaller 1989 Loma Prieta earthquake, there were 69 main breaks and 54 service

---

[51] See SF Fire Commission Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf at p.1. A copy of SFFC Resolution 2010-01 is attached as Appendix M.

[52] Metcalf & Eddy, at p. 18, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The SFPUC has initiated a planning study to better understand the current level of reliability of the entire potable distribution system, focusing on backbone pipes, but that study will take several years to complete.

[53] See SFPUC's WSIP webpage, https://sfwater.org/index.aspx?page=114 .

[54] See, e.g., list of WSIP projects at https://sfwater.org/index.aspx?page=968 .

[55] Metcalf & Eddy, at pp. 18-19, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The Civil Grand Jury is not questioning the importance or the efficacy of the WSIP, which is essential to rapidly restoring potable water service to residents following an earthquake. But fire suppression needs an immediately available supply of water, which the MWSS is unlikely to be able to provide following a major earthquake.

[56] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, p. 6. Other reports have provided somewhat different, but still extremely high estimates. Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 13 [over 28,000 breaks, including service breaks]. But whatever the precise number of water main breaks in 1906, the earthquake devastated the water supply system which contributed to the horrific fires that nearly destroyed the City.

connection breaks in the Marina district alone.[57] Because of these breaks, low-pressure hydrants located in the Marina could not provide adequate water or pressure for firefighting.[58]

Other recent major earthquakes have also caused substantial damage to municipal water supply systems. In the 6.7-magnitude 1994 Northridge earthquake, there were over 1,000 water main breaks and over 100 fires.[59] In the 6.9-magnitude 1995 Kobe, Japan earthquake, "water loss seriously impaired firefighting."[60] There were over 2,000 breaks in the underground piping, and large fires burned freely due to lack of water.[61] Similarly, in the 2011 Eastern Japan earthquake there was extensive damage to water supply lines.[62] Even the relatively small 6.0-magnitude 2014 South Napa earthquake "highlighted the vulnerability of water and wastewater systems to earthquake-related ground failure, the additional fire hazards that earthquake-related water system failures can pose, and the fiscal challenges that public agencies face in improving the seismic resiliency of these systems, both pre- and post-earthquake."[63]

Experts have predicted that in a future major San Francisco earthquake, the MWSS could sustain over 1,000 breaks.[64] Various reports have said it in different ways, but the clear takeaway is that the MWSS should not be relied upon to save the City from fires following a major earthquake:

- "MWSS pipes will sustain damage in certain areas of the City, which will impair the ability to deliver water for firefighting."[65]
- "In such an emergency it is likely that the potable water distribution system would be compromised by pipe breaks and leaks."[66]

---

[57] CS-199, at p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; see also O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996) ("O'Rourke, Lessons Learned").

[58] Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

[59] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 16; O'Rourke, Lessons Learned, at p. 3.

[60] O'Rourke, Lessons Learned, at p. 3.

[61] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 18-19.

[62] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 24.

[63] Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf, Finding 2.3, at p. iii.

[64] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2.

[65] CS-199, p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

- "...the usual firefighting water supplies will almost certainly fail...."[67]
- "World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake."[68]

Moreover, unlike AWSS hydrants, low-pressure hydrants connected to the MWSS require a fire engine to extract and pump the water to sufficient pressure for firefighting.[69] Given that fire engines are likely to be in high demand and potentially overwhelmed in a major earthquake, this is yet another reason why an alternative source of water is necessary.[70]

E. Cisterns Provide Limited Protection

Cisterns are underground tanks, unconnected to any water source.[71] Typically, cisterns in San Francisco hold approximately 75,000 gallons of water.[72]

The City has 229 cisterns located throughout the City, as shown by Figure 4 on the next page[73]:

---

[66] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[67] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 39.

[68] SFFC Resolution 2010-01, p. 1, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf and attached as Appendix M.

[69] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 55-56.

[70] Scawthorn, O'Rourke & Blackburn, 1906 Lessons, at pp. S153-1S54, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf .

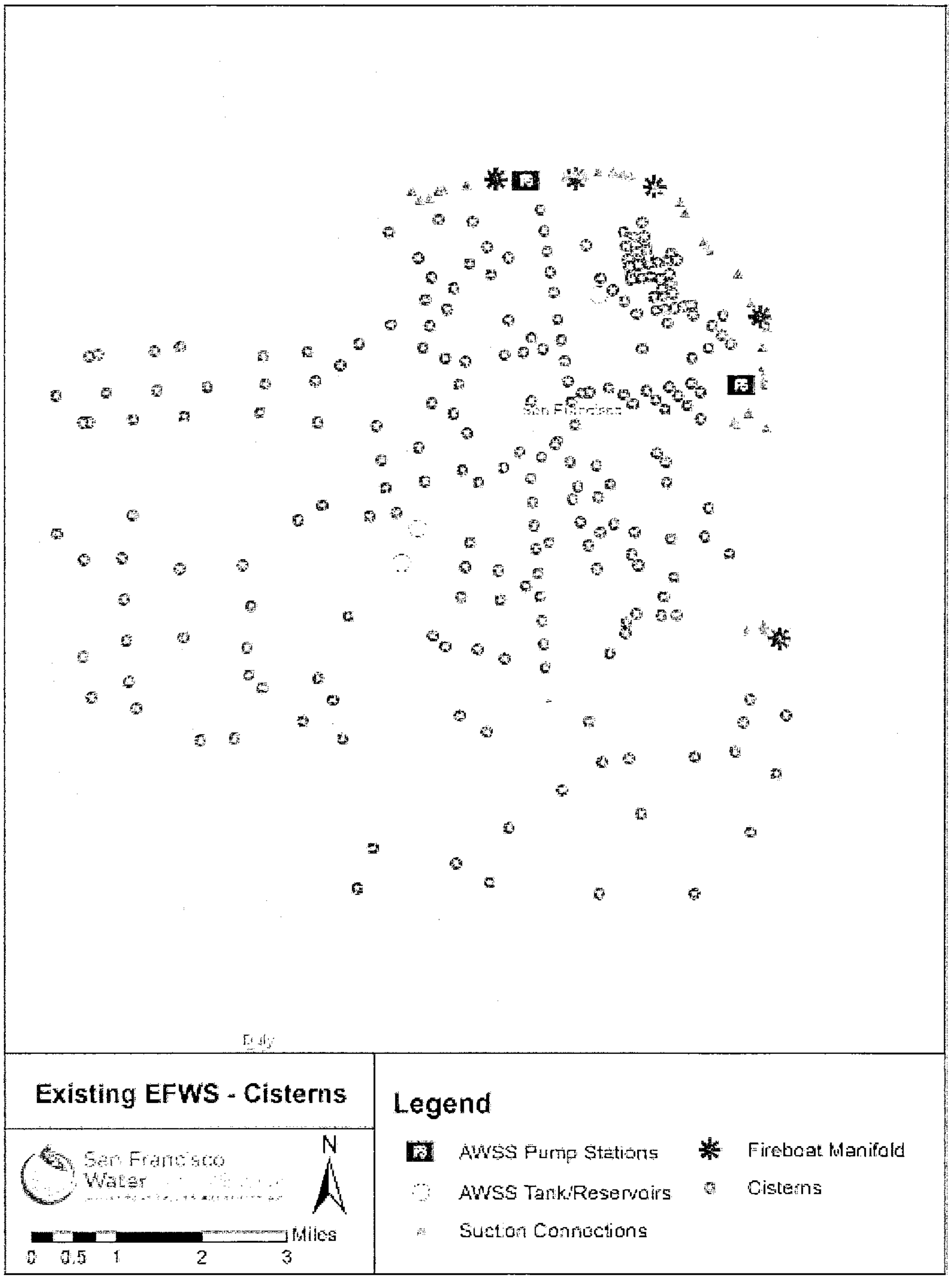
[71] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at p. 13.

[72] See SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 6.13-6.17; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at p. 77.

[73] Map provided by SFPUC on May 7, 2019.

Figure 4

Map of Existing Cisterns



By Supervisorial District, the breakdown of cistern locations is listed in Table 4 below.

Table 4

Cisterns by Supervisorial District

Supervisorial District	Cisterns
1	17
2	23
3	46
4	12
5	20
6	26
7	12
8	27
9	21
10	20
11	5
TOTAL	229

Notably, Districts 1, 4, 7 and 11, which currently have the fewest miles of HP AWSS pipelines, also have the fewest cisterns. This is especially true of District 11, with only one mile of AWSS main pipeline and only five cisterns. [74]

Cisterns provide a valuable backup or "last resort" in the event of damage to the MWSS and AWSS. In the 1994 6.7-magnitude Northridge earthquake, the MWSS suffered over 1,000 water main breaks.[75] Firefighters used backyard swimming pools as water supply sources. In the 1906 earthquake, San Francisco's 23 cisterns were credited with saving a major building in the Financial District when the water mains broke.[76]

Cisterns, however, have limited capacity[77] and are therefore unlikely to be effective against serious fires following a major earthquake. In the 1995 6.9-magnitude Kobe earthquake,

---

[74] In recent years, the SFPUC has built 30 additional cisterns, funded by the 2010 and 2014 ESER bonds. These 30 new cisterns are included in the totals in the above table. Half of these new cisterns were strategically located in the Richmond and Sunset districts, which now have 17 and 12 cisterns, respectively, to begin to address concerns that those areas of the City were inadequately protected. SFPUC 2017 FAQ, Question 4, https://sfwater.org/modules/showdocument.aspx?documentid=11507 .

[75] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at pp. 12-17.

[76] Scawthorn 1987, http://www.sparisk.com/documents/AIRACFFEs.pdf , at p. S140.

[77] SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 5.6-5.7.

however, the city's 968 cisterns provided little help to firefighters because they drained in 10 minutes.[78]

San Francisco's typical cistern would drain within an hour of continuous firefighting.[79] Given that on average it takes several hours to put out a four-alarm fire,[80] cisterns cannot be expected to successfully fight post-earthquake conflagrations in parts of the City not protected by AWSS. In addition to providing limited firefighting water, cistern water must be extracted and pressurized by an engine, requiring more staff and time to deploy than, for example, AWSS hydrants.[81]

F. The PWSS Inventory Needs to Be Modernized and Expanded

In addition to the MWSS and cisterns, the SFFD intends to rely on the City's Portable Water Supply System, or PWSS, to fight fires in non-AWSS areas.

In the 1980s, the SFFD developed and implemented the PWSS, an above-ground, large-diameter hose system used to move water great distances from a water source to a fire. PWSS units consist of a hose tender, or truck, equipped with approximately one mile of large-diameter five-inch hose (larger than the normal three-inch hose), along with a portable pump, portable hydrants that allow water to be distributed from a large-diameter hose, and other essential firefighting equipment.[82] With its portable pump, a hose tender can be used to draft and pressurize water from alternative water sources, such as lakes, lagoons, a fireboat (as in the 1989 Loma Prieta earthquake), cisterns, or even broken water mains. It can also be used to extend the reach of the HP AWSS system to blocks or neighborhoods without a HP hydrant.[83]

---

[78] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 17-19. San Francisco's cisterns are larger than Kobe's, but the point remains they are only good for a limited duration. *Id.*, at p. 77.

[79] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 77.

[80] Information provided by SFFD.

[81] CS-199, at pp. 13, 56, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[82] Scawthorn, O'Rourke, Blackburn, S150-151. A detailed description of the PWSS can be found in Scawthorn, C. and Blackburn, F. (1990), Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC. The PWSS and its five-inch hoses are different from a prior, abandoned concept of a Flexible Water Supply System, using massive, 12-inch hoses in lieu of expanding the HP AWSS. That concept was proposed in AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246. It was abandoned as impractical after concerns over, among other things, how 12-inch diameter hoses would block traffic.

[83] Figure 6-1 on page 83 of CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, is a map of the City showing how the PWSS can be used to expand the areas protected by the AWSS. Figure 6-1 assumes certain extensions of the AWSS

Currently, there are only five PWSS hose tenders, three of which are located in the "unprotected areas"[84] of the Sunset district and Hunter's Point. In the SFFD's opinion, the PWSS hose tenders are "past their useful life."[85] The newest hose tender, housed in the Sunset, is 27 years old. The second newest, in Hunter's Point, is over 30 years old. The remaining three are over 45 years old.[86]

Firefighters and emergency response experts have been calling for a large-scale expansion of the PWSS for years.[87] In January 2010, the San Francisco Fire Commission (SFFC) issued Resolution 2010-01, encouraging the SFFD to pursue approximately $10 million in grant funding to expand the PWSS. The SFFC recognized that the City's MWSS is highly vulnerable to a catastrophic failure in the event of a major earthquake, and that the AWSS does not cover the entire City. The SFFC declared that the PWSS has been proven effective in the above-ground transmission of water for firefighting, that the PWSS can work in conjunction with and supplement the AWSS, and that the City did not have a sufficient number of units to supply all areas of the City where the AWSS does not extend.[88] Unfortunately, that grant was not funded, and the City has not yet purchased any additional PWSS hose tenders.[89]

Also in 2010, the Applied Technology Council issued several reports as part of the City's Community Action Plan for Seismic Safety, or the "CAPSS Project."[90] Among its recommendations was one similar to ours: Improve emergency water supply systems to cover those neighborhoods not served by the HP AWSS. As explained in that report,

> The Auxiliary Water Supply System provides a redundant water system for fighting fires after earthquakes and at other times, and incorporates many earthquake resistant features in its design. However, this system covers only northern and eastern City neighborhoods, those that were developed in the early

---

that do not presently exist, and does not take into consideration the limited size of the existing PWSS inventory. As a result, Figure 6-1 in CS-199 overstates the current level of protection, but does show what could be accomplished with a larger inventory of PWSS hose tenders.

84 These areas are of course not completely unprotected, but as discussed above they do not have a HP AWSS. The City's outside expert AECOM/AGS, A Joint Venture, has referred to the portion of the City protected by the HP AWSS as the "Protected Area." See CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

85 Information provided by SFFD.

86 Information provided by SFFD.

87 See Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990, attached as Appendix Q.

88 SFFC Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf

89 Information provided by SFFD.

90 According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts. See https://sfgov.org/esip/capss .

part of the last century when the system was constructed. *The City needs adequate, reliable water sources to fight post-earthquake fires in all neighborhoods. There are a number of options to improve the water supply in neighborhoods not served by the Auxiliary System, including expanding the City's Portable Water Supply System, which can be deployed wherever needed. This important issue needs to be addressed as soon as possible.* (Emphasis added)[91]

In 2014, outside consultant AECOM/AGS, a Joint Venture, advised the City that "[a]dditional PWSS units would be a prudent investment for SFFD/SFPUC."[92]

The SFFD submitted a request for funding to purchase 20 newly designed PWSS hose tenders in the fiscal year 2019/2020 budget, but the Civil Grand Jury understands that only four new PWSS hose tenders are included in the Mayor's May 31, 2019 two-year budget proposal.[93] The proposed new SFFD hose tenders are designed to be more efficient and maneuverable than older models, with four-wheel drive to overcome obstacles on roads, the ability to carry up to 6,000 feet of five-inch fire hose, and only one firefighter required to operate each vehicle. Each vehicle will have a high-volume onboard water pump, and a portable submersible water pump. Both pumps will be able to draft water from the Bay, reservoirs, or other water sources. These new hose tenders could be connected together to carry water over many miles of the City. The SFFD estimates these new PWSS vehicles, fully equipped with hoses and appliances would cost approximately $1 million per vehicle.[94]

Given the time required to build or extend a HP pipeline system, acquiring additional PWSS hose tenders is a practical intermediate step to enhance fire protection throughout the City. The SFFD advised the Civil Grand Jury that additional PWSS hose tenders could be acquired and in service within a year or so, or at the outside two years. The failure to obtain grant monies should not stop the City from making this important investment in public safety.

Although the Civil Grand Jury recommends immediately replacing and expanding PWSS units, this is not a long-term solution. A successful PWSS deployment requires a nearby water source, and personnel to unwind a mile of heavy, five-inch-diameter hose through potentially

[91] Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety (2010), prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project, at pp. 53-54, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

[92] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 85. Although this report referred to the PWSS as an investment in the colloquial sense, the PWSS is not a fixed asset and thus does not involve a capital expenditure. As such, purchasing new hose tenders will need to come from city funds, not bonds. The Civil Grand Jury nevertheless believes that acquiring more PWSS hose tenders is long overdue.

[93] Information provided by SFFD. The City's budget process is of course ongoing. It is therefore uncertain whether the Board of Supervisors will approve sufficient funding for the four new units or conversely whether the Board of Supervisors will increase the funding for purchasing new PWSS units. We also understand that a request for funding for PWSS hose tenders has been made to state officials, but at this time the SFFD does not know if that request has been approved.

[94] Information provided by SFFD.

congested and damaged city streets.[95] Moreover, although hose tenders can draft water from the Bay, they are not designed for use in the ocean – the only unlimited water source on the west side of the City.[96] Given these challenges, PWSS is essentially an important but temporary "Plan B."

G. Efforts to Expand the High-Pressure AWSS Need to Be Accelerated

As discussed in Section B above, the USGS estimates there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area before 2043.[97] In early April of 2019, USGS researchers issued a new study warning that "the next 100 years of California earthquakes along [the San Andreas, San Jacinto and Hayward] faults could be a busy one."[98] Each year we delay construction of an expanded HP AWSS we are gambling, pushing our luck that a major earthquake won't hit before we're ready.

City departments, including the SFPUC, which assumed jurisdiction over the operation and maintenance of the AWSS from the SFFD in 2010, have been analyzing the reliability of the EFWS and the possible expansion of the HP AWSS for over a decade.[99] An analysis in 2009 indicated that the EFWS was "47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake."[100] In actuality, and as discussed in Section I below,[101] the SFPUC's consultant's metric is overly optimistic: a 50% score really means that we will have about half of the water needed to meet *median* firefighting demands following a 7.8-magnitude earthquake. Put differently, if the firefighting demands are above the median estimate, this analysis indicates that even with a score of 99% there will be insufficient water to meet the demand.

---

[95] Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, at pp. 4-5; information provided by SFFD.

[96] According to the SFFD, there is no known SFFD access to the ocean on the western side of the City, but SFFD is continuing to investigate potential access areas where it might be able to use a PWSS unit.

[97] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020, https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

[98] See *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[99] See e.g., Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, CS-199 (2014), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229 (2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, 2018 Westside Options Analysis (2018), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, among other reports.

[100] SFPUC FAQ, Question No. 3, https://sfwater.org/modules/showdocument.aspx?documentid=11507 and attached as Appendix N.

[101] See pages 35-36 below.

Figure 5, below, shows EFWS reliability by so-called Fire Response Areas (FRAs)[102] as of 2010, i.e., prior to recent improvements.

Figure 5
Map of EFWS Reliability Scores by FRA as of 2010[103]

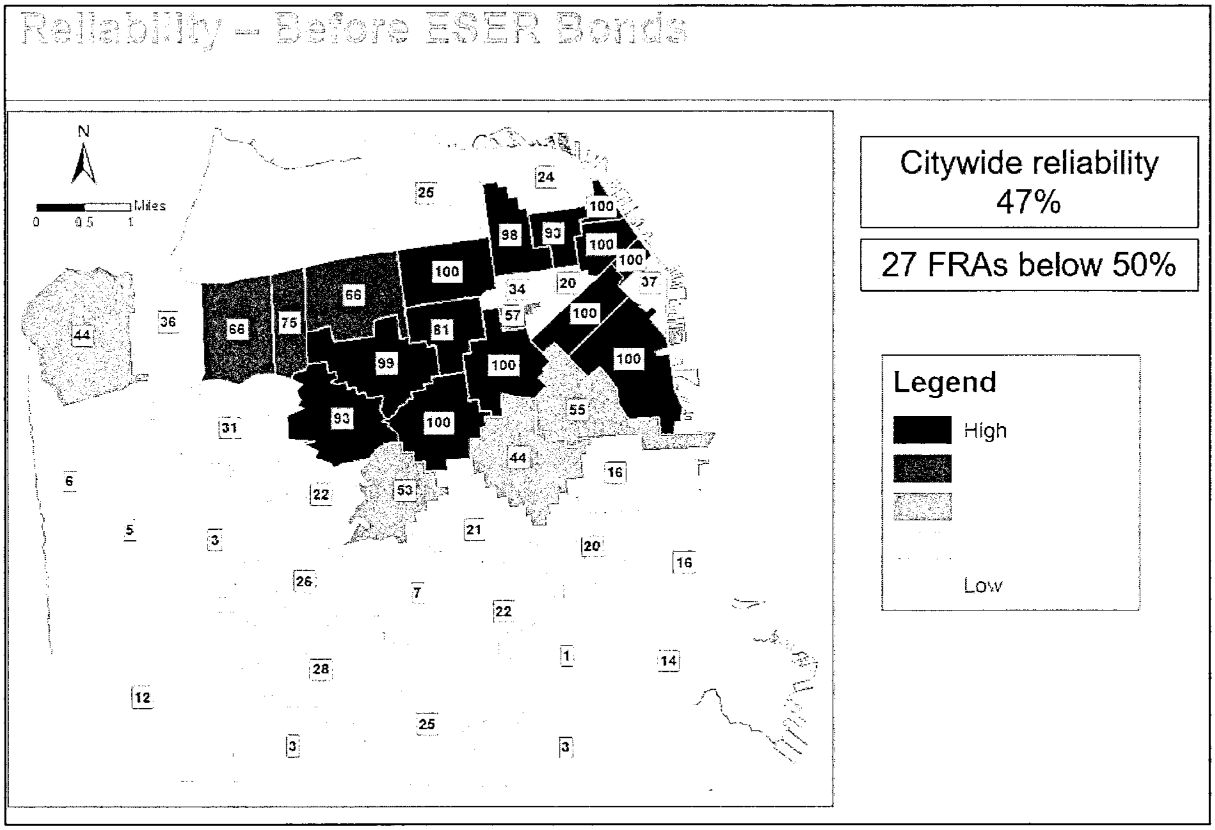


Figure 5 shows that as of 2010 the majority of the City scored below 50%, and in some cases far below. In 2010 and again in 2014, voters approved Earthquake Safety and Emergency Response (ESER) Bonds. The 2010 ESER bonds provided approximately $102 million for the EFWS, and the 2014 ESER bonds provided $54 million. The money was spent on assessing the existing HP AWSS, rehabilitating and upgrading core facilities (existing water storage tanks, pipelines, salt-water pumping stations) that needed seismic strengthening or other repairs or improvements, adding 30 cisterns, and other tasks.[104]

---

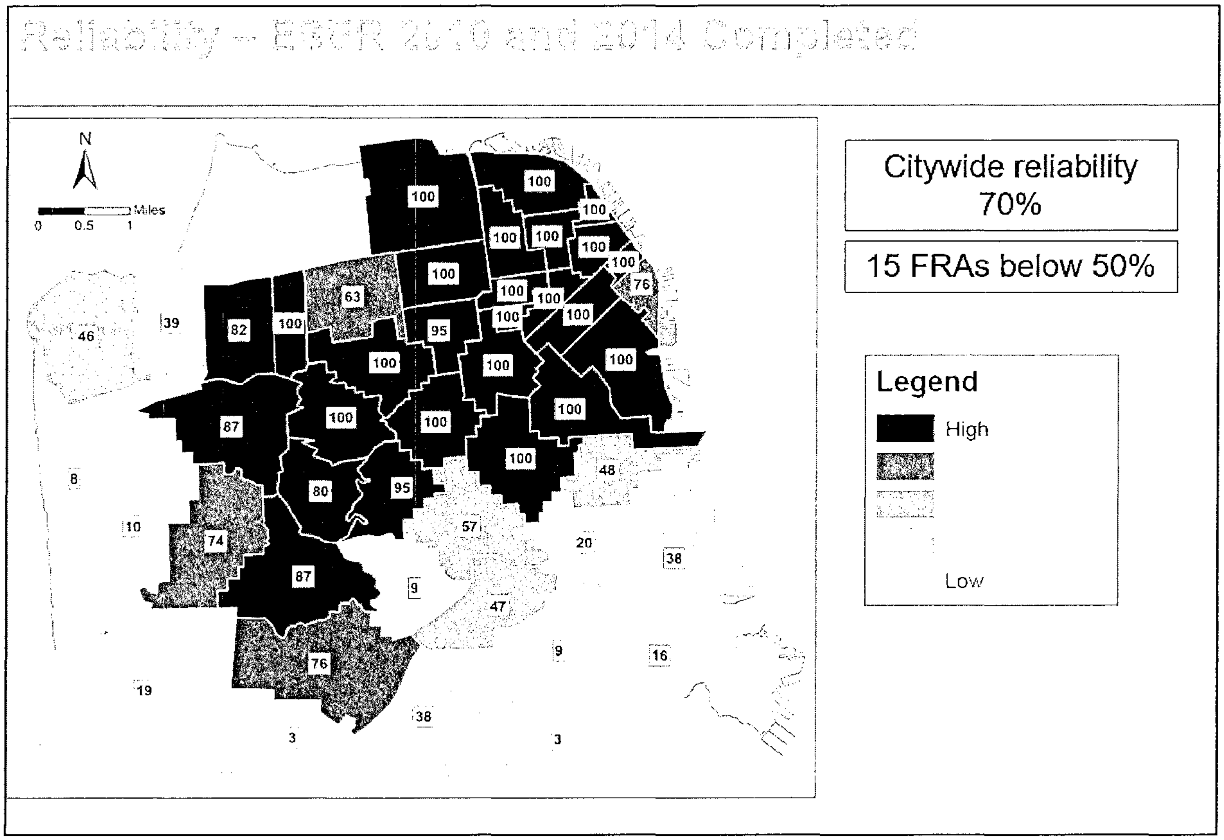
[102] The SFFD divides the City into 46 areas for initial alarm response, also referred to as Fire Response Areas or FRAs. A map showing the different FRAs is attached as Appendix J.

[103] Map supplied by SFPUC. Identical map, except for legend, in AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907 at p.3.

[104] A February 26, 2019 status list provided by the SFPUC for the various projects undertaken pursuant to the 2014 and 2014 ESER bonds, showing which are in planning, in design, in construction, complete, canceled or

The result has been significantly improved EFWS reliability scores, as shown by Figure 6:

Figure 6
Map of EFWS Reliability Scores by FRA After 2010 and 2014 ESER Bond Work Completed [105]



The SFPUC has performed important work in analyzing what needs to be done and by repairing existing facilities. *But today, nine years after the 2010 CAPSS report called for action as soon as possible, 16 years after the 2002-2003 Civil Grand Jury called for expanding the HP AWSS to the entire City, almost 33 years after the 1986 Fire Protection Bonds Analysis stating*

postponed is attached as Appendix O. See also Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found at http://www.sfearthquakesafety.org/eser-reports.html

[105] This map assumes completion of work in progress, which is expected by late 2020 according to the SFPUC. The SFPUC has retained outside experts to update the anticipated water demands by FRA but that work has not been completed.

the improvements would include extending the HP AWSS and installation of a HP pump station at Lake Merced, and over a hundred years after the AWSS system was first built, we are still decades away from reliably protecting all neighborhoods.

Over the past year, the SFPUC has made substantial progress in developing plans to improve EFWS on the west side. Specifically, the SFPUC and the SFFD propose to develop a new, separate AWSS system using potable water ("Potable AWSS") for the western part of the City. The Potable AWSS approach contemplates a dual-purpose pipeline, independent from the existing HP AWSS network.[106] The Potable AWSS would function as a potable water transmission main during normal operations and would provide HP emergency firefighting water supply for major fires. The new pipeline would provide "daily reliability and water quality benefits as well as a post-earthquake potable water supply to the Richmond and Sunset districts",[107] but in the event of an earthquake or other emergency, the transmission main would automatically be isolated from the remainder of the potable distribution system and converted to a dedicated HP system, similar to the existing or conventional AWSS.[108] To increase reliability, the new pipeline would be made of modern, seismically reliable material.[109]

The SFPUC currently anticipates having approximately $195 million,[110] from water rates and from an expected 2020 ESER bond (assuming voter approval), to spend on extending the HP AWSS and improving EFWS reliability over the next five to seven years.[111] The current Potable AWSS proposal is divided into two phases, as the projected $195 million is insufficient to

---

[106] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at pp. 7, 10, 13.

[107] *Id.*, at p. 8. The Potable AWSS would eliminate the need for a project that the SFPUC had been planning to supply potable water to the Richmond District, saving up to $30 million. *Id.* Today the potable water supply to the Richmond District depends on two transmission mains that run north from the Sunset District. One of those mains was built in 1915. The other was recently replaced with a ductile iron main. The Potable AWSS would provide a third transmission main, built with modern earthquake resistant pipe. *Id.*, at p. 13.

[108] A detailed description of the Potable AWSS concept can be found in CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229, https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, and 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740. The actual proposal has evolved over time, so the alignment discussed in those 2014, 2015 and 2018 reports has changed, as have the water sources. This plan is still under review and the alignment may well change again before the plan is finalized and ready for any required public hearings or environmental or other review. But the underlying concept of a Potable AWSS and how it would operate remains the same.

[109] New pipe would be so-called Earthquake Resistant Ductile Iron Pipe (ERDIP), the most seismically reliable pipe available. ERDIP pipe performed admirably in several recent Japanese earthquakes See Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 6, re ERDIP pipe.

[110] Information supplied by the SFPUC. The $195 million is adjusted for inflation as the build out will occur over several years. This is roughly equivalent to $160 million in 2018 dollars according to the SFPUC.

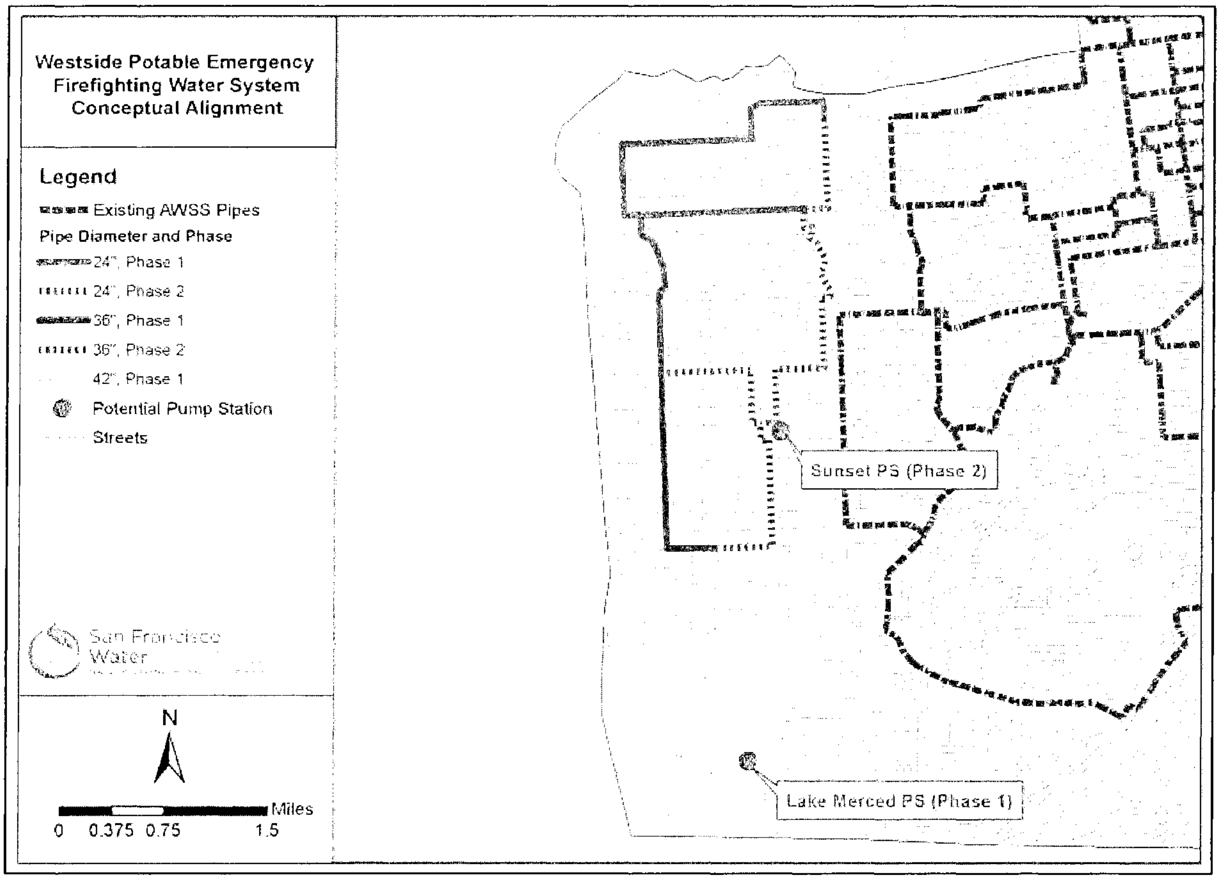
[111] Meetings with SFPUC representatives. The Board of Supervisors approved the 2020-2029 ten-year Capital Plan at its April 30, 2019 meeting. See https://sfbos.org/sites/default/files/bag043019_minutes.pdf . The new ten-year Capital Plan can be found at http://onesanfrancisco.org/the-new-plan/overview .

complete the entire project. Phase 1 involves adding approximately 8.6 miles of new pipe.[112] A conceptual potential pipe alignment would extend north from Lake Merced along the west side, through the western portion of the Sunset and Richmond districts, and then have two pipelines head east, one immediately south of the Presidio and one in the southern Richmond district.[113]

A conceptual potential alignment of both Phase 1 and Phase 2 is shown in Figure 7 below:[114]

Figure 7

Conceptual Potential Alignment for Potable West Side AWSS



[112] Information provided by SFPUC. The phasing and the potential, proposed or conceptual alignment discussed above and on the following pages are still in the planning stages and are subject to change. Detailed designs have not yet been completed, much technical analysis remains to be done, and the project has not yet undergone environmental reviews.

[113] The current furthest west AWSS pipeline is located east of Park Presidio Boulevard.

[114] Provided by the SFPUC on April 10, 2019. See footnote 121 on page 32.

The Potable AWSS pipeline network would tie into an existing, recently seismically reinforced, potable 60-inch transmission main, providing a source for normal, potable-water operations.[115] The proposed Phase 1 also includes adding a new HP pumping station at Lake Merced.[116] Although the water in Lake Merced is deemed non-potable, Lake Merced contains approximately a billion gallons or more, making it an excellent source of water for emergency firefighting purposes.[117]

The SFPUC and SFFD's future west side plans (Phase 2) include an additional 5.6 miles of pipeline for better coverage and potentially an additional pumping station at Sunset Reservoir, for another source in case of a broken pipe or other emergency.[118] However, the SFPUC and the SFFD do not anticipate having the additional approximately $120 million[119] needed to complete that portion of their plan until the next round of ESER bonds, which may not be for another five to seven years or even longer.[120]

Unfortunately, the Potable AWSS on the west side only addresses the EFWS deficits on the west side of the City. Many other City neighborhoods along its southern part, from Park Merced in the west to Visitacion Valley in the east, will be no closer to having a multi-sourced, seismically reliable HP AWSS or substantially enhancing their neighborhood's EFWS even if this westside Potable AWSS plan moves forward.

---

[115] According to the SFPUC, this transmission main connects to both (a) the Crystal Springs Reservoir in San Mateo County and to the 9'6" Crystal Springs Bypass tunnel, which is supplied by Calaveras Reservoir, San Antonio Reservoir, and the SFPUC's upcountry water sources (Hetch Hetchy, Don Pedro, etc.). These potable water sources were seismically reinforced by the SFPUC's Water System Improvement Program (WSIP), a $4.8 billion program to improve water system reliability, including seismic reliability. See SFPUC webpage on WSIP, https://www.sfwater.org/index.aspx?page=114 .

[116] Like the conceptual potential pipeline alignment, the size, location and design of any new pumping station is at present unknown and uncertain. The Civil Grand Jury understands that the Potable AWSS project is currently moving forward with design, technical studies, environmental and management reviews, but is of course also dependent upon approval of necessary funding.

[117] Information provided by SFPUC; see also V. Matuk and N. Salcedo, Lake Merced Hydrology and Water Quality, http://online.sfsu.edu/bholzman/LakeMerced/water.htm ("Estimates of the capacity of the lake also vary greatly from a low of 768 million gallons to high of 1.93 billion gallons."). The Sunset pumping station shown in the figure on the preceding page is being considered as a potential part of Phase 2.

[118] Per the SPFUC, the Sunset Reservoir Pumping Station will also be connected to a seismically reinforced, potable 54-inch transmission main. Unlike the northeast quadrant, where the AWSS pipeline system is a grid and thus provides an excellent measure of redundant support in case of a broken pipe, the proposed Potable AWSS would not be a grid. The lack of redundant pipelines creates a somewhat higher level of risk. However the use of modern ERDIP significantly reduces the risk of pipeline failure, and having redundant water sources provides additional comfort as it would enable back-feeding and reduces the risk of a potential single point of failure. 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

[119] This cost estimate is in 2018 dollars. Unless otherwise stated, all cost estimates provided by the SFPUC, SFFD and SFDPW to the Civil Grand Jury for work on the EFWS system and discussed in this report are in 2018 dollars.

[120] Even if new bonds are issued in five to seven years, design and construction of the new pipelines and new pumping station would take several more years.

The limited scope of the SFPUC's current plans is the result of budgetary constraints. The Mayor and the Board of Supervisors determine what bond proposals are placed before the voters, how frequently, and what is included. The SFPUC and the SFFD must operate within the financial constraints they are given.

The SFPUC has rough estimates showing that extending the high-pressure AWSS throughout the City–or building separate but functionally equivalent Potable AWSS systems in areas without a HP AWSS–will cost approximately $500 million in addition to the funds already targeted for Phase 1 of the Potable West Side system, as discussed above.[121] The SFPUC is not presently planning a programmatic City-wide expansion; it merely has developed a rough list of possible projects for various parts of the City that are not presently served by the HP AWSS (as well as other projects to reinforce or otherwise improve the HP AWSS system in those areas that are currently served by the HP AWSS).[122]

This roughly $500 million estimate is a huge amount of money, but as discussed in Section A above, the risk of incurring the costs from a major, inadequately-fought fire is far greater.

First and foremost is the risk to human life. In 1906, an estimated 3,000 people lost their lives, and 225,000 were left homeless. The City is obviously much better prepared today, with

---

[121] See "Candidate EFWS Projects" list dated May 8, 2019, attached as Appendix P. The actual total of projects related to system expansion is approximately $485 million, plus the $160 million for Phase 1 of the Westside project, for a total of $645 million. We have rounded the $485 million up to $500 million for the sake of simplicity and in recognition of the fact that these are all very preliminary high level estimates.

This Candidate EFWS Projects list is an internal SFPUC document: it is a list of potential project alternatives provided by the SFPUC staff to the EFWS Management Oversight Committee. The list contains potential projects that could be implemented in the future if approved by the EFWS Management Oversight Committee, if funding is made available, and if and when they go through the required environmental review. Due to the preliminary nature of the list, some of the estimated costs on this candidate project list are merely planning level estimates and would likely change if the SFPUC decided to move forward with a detailed design for a given project. Some of these projects, such as the Potable AWSS on the west side, are moving forward towards completion of design and technical studies and required environmental review based on management direction and the anticipated availability of funds. However, others are still simply candidate project alternatives that management may never proceed with.

This May 8 Candidate EFWS list also includes various proposals and potential projects to improve the seismic safety of the approximately 20 miles of HP AWSS pipes in the so-called infirm zones, as well other supply or proposed projects under consideration unrelated to any potential HP AWSS expansion. May 8, 2019 Candidate EFWS Project list attached as Appendix P; see CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 31 for a map of infirm zones.

Although the original AWSS system was designed to be seismically strong, and to survive an earthquake, it was designed shortly after the 1906 earthquake and installed by 1913. Most of the AWSS pipelines fared well during the Loma Prieta earthquake, although that was 60 miles away and not as big an earthquake as we will someday face. See, e.g., PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 9-12. Accordingly, no one knows for certain how the existing AWSS will fare in a major earthquake, especially in liquefaction areas or so-called infirm zones. The infirm zone projects, which are estimated to cost $135 million, involve installing new, backbone ERDIP pipe in each infirm zone, so that even if the existing AWSS pipe fails there will be at least one reliable major high-pressure pipeline in each area. Information provided by SFPUC; see also Appendix P.

[122] The recently approved 2020-2029 ten-year Capital Plan does not designate nearly enough money for EFWS to complete a City-wide expansion of the HP AWSS system. See http://onesanfrancisco.org/the-new-plan/overview

fire suppression systems, the existing HP AWSS, and modern building standards. Yet the 2017 North Bay fires and the 2018 Camp fire that destroyed the town of Paradise demonstrate how destructive and fast-moving fires can be under windy conditions. [123] In 1906, residents fled to the south and the west, to relatively uninhabited portions of the City that did not burn. Today, the entire City is densely populated and there would literally be no place for residents, especially our many senior citizens, to run to escape a fast-moving conflagration.

Second, in terms of property value, San Francisco has billions of dollars at risk. As discussed in Section A of this report, and in particular Table 1, a 2010 report prepared for the City estimated the range of losses due to fire following an earthquake could exceed $10 billion for a 7.9-magnitude event – in 2010 dollars. The damage estimates in Table 1 do not include business interruption losses, loss of tourism or loss of property tax revenues, all of which would undoubtedly be substantial.[124]

The substantial increase in San Francisco property values over the last decade undoubtedly increases the potential losses. In light of the dire consequences we face, the approximately $650 million price tag to expand the HP AWSS throughout the City (which includes Phase 1 of the proposed Potable AWSS on the west side), seems well worth the expenditure.

The Civil Grand Jury is not in a position to know whether each of the SFPUC's potential projects is essential, how the costs will change after detailed design work, further studies and environmental reviews, or whether more cost-efficient approaches exist. We are also not in a position to weigh the relative merits of the approximately $320 million in non-expansion-related projects on the SFPUC's Candidate EFWS Projects list.[125] But we do know that the current approach is taking too long. The SFPUC itself estimates that build-out of the AWSS "would take ~ 35 years using current funding rate assuming 5 year bond cycle."[126]

The most recent public timeline provided by the SFPUC is in CS-199, and is moot as the various projects have evolved over time. However, that timeline relies upon the issuance of

---

[123] As discussed above, wind is a major factor in fire spread. See, e.g., Kearns, F. and Moritz, M., *The Conversation* (November 16, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985; Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp. 8-9, 15, 18-19. The 1923 Tokyo earthquake and subsequent fires are probably the most devastating in peacetime, with substantially greater loss of life (an estimated 140,000 killed) than the 1906 earthquake. See Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019 at pp. 1-2, 19-23; see also Great Tokyo Earthquake of 1923, at http://factsanddetails.com/japan/cat26/sub160/item2226.html. Among the reasons for the devastation in Tokyo were winds of approximately 28 miles per hour at the time of the earthquake, with increasing wind throughout the day. *Id.*

[124] See CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 95-97.

[125] See May 8, 2019 Candidate EFWS Projects list, attached as Appendix P.

[126] SFPUC Emergency Firefighting Water System, Management Oversight Committee presentation dated March 4, 2019, at p. 32. The City is not committed to a five year bond cycle, so it could be even longer, although the increased level of funding in the proposed 2020 ESER bond indicates that things may be moving more rapidly.

ESER bonds every five to seven years, through and including a 2045 bond issuance, such that work would not be completed until 2049.[127]

Either way, this means that areas of our City, such as District 11, would not be as well protected as other areas, and would not have a HP AWSS in place if, as predicted by the USGS, a major earthquake hits the Bay Area before 2043.

Accordingly, the Civil Grand Jury recommends a major acceleration of these efforts, such that all areas of the City are protected by a seismically sound, multi-sourced, HP emergency water firefighting system within 15 years, i.e., by no later than 2034.

H. The Bottom Line: Act Fast, but Ensure Redundancy

Among the most important factors in designing an EFWS is redundancy. This is true whether the City chooses to extend the existing AWSS or to adopt a different approach. Regardless of the specific plan, there must be multiple, redundant sources of water such that if one source fails or a pipe breaks, firefighters have other means to obtain necessary water supplies.

In the Loma Prieta earthquake the Marina district was saved by the combination of the PWSS and a fireboat, or "the backup to the backup."[128] Unpredictable stuff happens, especially in a major earthquake, and redundancy is necessary.[129] This means not just looped pipe systems but also multiple sources of water. One of the great ironies of the 1906 earthquake is that San Francisco is surrounded by water yet it burned due to a lack of water.

The original HP AWSS was designed with both a redundant water supply and a gridded main system.[130] The system in the northeast quadrant of the City "seeks high post-earthquake

---

[127] Figure 5-1, *Preferred Alternative Planning Level Schedule,* from CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 71, and attached as Appendix R.

[128] See Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992); Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC; Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018).

[129] See, e.g., Metcalf & Eddy, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00 at p. 20; CS-199, at p. 11 ("Multiple redundancies in fire water supply systems are necessary."), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[130] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

reliability via multiple sources of supply."[131] Those sources include two above-ground storage tanks, a reservoir, two salt-water pumping stations, plus several fire boat manifolds if needed.[132]

Many citizens have called for installing a salt-water pump station or stations on the west side, arguing that the ocean provides an unlimited source of water.[133] A salt-water pump station north of Golden Gate Park would also provide geographic diversity of water sources, as the other proposed pumping stations and HP water sources are all south of Golden Gate Park. Dr. Scawthorn, the City's consultant, has asserted that a salt-water pump station on the west side "would be very beneficial."[134]

The Civil Grand Jury recognizes that this may raise environmental and other issues, and may or may not be necessary in light of the potential use of Lake Merced.[135] Nevertheless, the Civil Grand Jury strongly believes in having redundant and geographically diversified water sources, and developing a robust water source in the northwest quadrant of the City seems to us to be beneficial. Other areas of the City have added protection from the SFFD's four fireboats, which can be connected to the PWSS to provide an alternate water supply, as in Loma Prieta. Unfortunately, fireboats are not designed to work in the open water of the Pacific Ocean, and PWSS hose tenders cannot practically drive onto beaches to draft water from the ocean.[136] For these reasons, a salt-water pumping station on the west side seems particularly appropriate.

The need for further EFWS projects is underscored by two additional considerations, discussed more fully below. First, the reliability scores cited in the SFPUC's consultant's reports over-state how effective our current plans are likely to be upon completion. Second, these scores – and our safety – are predicated on being able to properly maintain and operate the existing AWSS assets, especially critical assets, so they are ready when needed.

---

131 Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 2.

132 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 7-8.

133 Pendergast, T, *Plan to Protect Neighborhood Abandoned*, Richmond Review (November 2017), https://sfrichmondreview.com/2017/11/02/plan-to-protect-neighborhoods-abandoned/ ; Fracassa, D, *SF Moves to Build Water System to Fight Fires for When the Worst Hits*, San Francisco Chronicle (February 11, 2018), https://www.sfchronicle.com/politics/article/SF-moves-to-build-water-system-to-fight-fires-12605847.php ; Doudiet, T., *Commentary–Sound the Fire Alarm!*, Richmond Review / Sunset Beacon (November 3, 2017), https://sfrichmondreview.com/2017/11/03/commentary-thomas-w-doudiet/ ; Wuerfel, N., *Commentary–SFPUC Misleads Public*, Richmond Review / Sunset Beacon (November 13, 2018), https://sfrichmondreview.com/2018/11/13/commentary-nancy-wuerfel-2/ .

134 Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, at p. 7.

135 Any plan to add a salt-water pump station would need to be responsive to concerns about reducing or even eliminating if possible any impacts on marine life.

136 Information provided by the SFFD.

I. Current FRA Reliability Scores Promote Overconfidence

The SFPUC's and the SFFD's goal is to provide a certain Level of Service (LOS) for emergency firefighting water supply throughout the City. In particular, the SFPUC has articulated the following LOS objective:

> AWSS will reliably provide water to supply the "probable fire demands" after a magnitude 7.8 San Andreas earthquake. Each FRA will have a minimum of 50% reliable water supply to meet probable fire demands. The Citywide average will be a minimum of 90% reliable water supply to meet probable fire demands.[137]

The Civil Grand Jury agrees with the goal that the City should be prepared to fight fires following a magnitude 7.8 San Andreas earthquake. However, we are concerned with the current measures of "reliability." As discussed below, the "reliability scores" being used by the City create a misleadingly optimistic impression and imply a false precision.

As explained in CS-199, "[i]n the context of this study, reliability is defined as the percentage of the water demand met by AWSS high-pressure system and other sources."[138] Put differently, the reliability score methodology "does not actually represent an estimate of reliability but is a ratio of the EFWS capacity and demand."[139]

The ratio of capacity and demand is a useful measure, but the scores being used are overly optimistic in that the estimated "demand" used is the *median* estimated demand.[140] By definition, half the time one would expect worse conditions and therefore greater demand for water to fight fires. Using a demand estimate that is by definition insufficient half the time is not truly preparing for a repeat of the 1906 earthquake.

The problem of using the median demand is exacerbated by the wide variation in the potential number of fires, fire size, and water demands.[141] As just one example, San Francisco was lucky that there was little to no wind during the Loma Prieta earthquake. Yet as any resident of our City knows, the City often experiences significant wind conditions.

Another problem with the reliability scores is that they ignore where in the FRA a fire is, as well as the size of each FRA. For example, the southeastern portion of the City has several geographically large FRAs.[142] Although water may be able get to the northern part of a particular FRA, the southern part of that FRA may not be as well protected. In addition, the

---

[137] 2018 Westside Options Analysis, at p. 7, https://www.sfwater.org/modules/showdocument.aspx?documentid=117400 ; CS-199, at p. 102, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 .

[138] CS-199, at p. ix, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[139] Scawthorn 2018 memo, at p. 6, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

[140] *Id.*, at p. 5.

[141] *Id.*, at p. 5.

[142] See map of FRAs, attached as Appendix J.

demand represents the water supply need for an entire FRA, and the scores assume that the SFFD "would utilize the Portable Water Supply System (PWSS) or engine relays to distribute the water supply within the FRA to the actual ignition locations."[143] This is an unrealistic assumption, given the City's current inventory of only five old PWSS hose tenders, and the likely demand on fire engines in a major earthquake with a multitude of fires.

The SFPUC is in the process of analyzing potential EFWS demands on a more detailed level, and has shared some of the preliminary results with the Civil Grand Jury. The Civil Grand Jury supports this approach and recommends that the SFPUC continue its efforts to make a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA.

J. Maintenance and Training Issues

1. Maintenance Issues

AWSS assets must be well maintained in order to be operational during an emergency. A 2014 study prepared for the SFPUC by its outside consultants AECOM/AGS, a Joint Venture found "maintenance deficiencies" because routine maintenance plans had not been established for all AWSS assets. Instead, maintenance was being performed on an "as needed" basis.[144]

During our investigation, the Civil Grand Jury learned that the SFPUC has not developed a number of the routine maintenance plans recommended in the 2014 report.[145] The SFPUC assured us that it has done a good job at maintaining AWSS, and disagrees with some of the recommendations in that 2014 report. Nevertheless, the SFPUC has yet to develop routine maintenance plans for some important AWSS assets.

As an example, the report recommended the SFPUC adopt plans to regularly exercise all AWSS system valves.[146] In response, the SFPUC expressed a "goal" to exercise critical valves every two years.[147] It has defined "critical valves" to include only 66 out of the approximately 1,685 valves in the HP AWSS system.[148] SFPUC personnel acknowledge that its current approach is not a "best practice," and that valves should likely be exercised on a regular basis. SFPUC personnel also acknowledge that its definition of what constitutes a "critical" valve requiring more frequent testing is probably too narrow.[149]

---

[143] 2018 Westside Options Analysis, at p. 37, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

[144] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 15-16, 24-26.

[145] Information provided by SFPUC.

[146] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 25.

[147] Information provided by SFPUC.

[148] Ibid.

[149] Interviews with SFPUC personnel.

In another instance, the 2014 report recommended that all suction connections be cleaned on a regular basis.[150] The SFPUC noted that suction connections were cleaned in 2014, but that the agency had not adopted a routine maintenance plan.[151]

Now that the SFPUC has had time to focus on the condition of the AWSS, the Civil Grand Jury recommends that it utilize "best practices" for the maintenance of AWSS assets, including valves and suction connections, and that the SFPUC, with the help of the SFFD, redefine which valves in the system are "critical," and, therefore, require more attention and priority in its maintenance plans.

2. Coordinated Training and Drills

Another recommendation in CS-199, the 2014 report prepared for the SFPUC by its outside consultant AECOM/AGS, a Joint Venture, was that the SFPUC "prepare an emergency response program and conduct training exercise [sic]."[152] The report also recommended that SFPUC staff be trained on the AWSS system, including "communications, operational strategies," and "emergency response requirements."[153] Both of these recommendations were given "high" priority, and assessed to entail "low" ongoing cost.[154]

In 2015, the SFFD and the SFPUC entered into a Memorandum of Understanding ("MOU") regarding the operation and maintenance of water-supply systems related to fire suppression.[155] In Section C, entitled "Coordinated Emergency Operations Between the SFWD and SFFD", the MOU requires that "All members of the SFWD … must be trained in the AWSS and the AWSS SCADA system along with the SFFD Water Supply manual."[156] The MOU also specifies that "[t]he SFFD and the SFWD will collaborate for annual training on system operations and appropriate shut-down procedures during and after firefighting operations."[157] The MOU, therefore, requires the SFPUC and the SFFD to coordinate to train all SFWD personnel on the

---

[150] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 15-16, 24-26, 88, 135. There are approximately35 suction connections along the bay that allow engine pumpers to draw by suction from the bay, and a suction line with low-pressure hydrants along Fulton St. that draws from lakes in Golden Gate Park. Some of these suction connections are located on the bottom of the Bay and can be filled with silt or marine organisms that would interfere with water pumping.

[151] Interviews with SFPUC personnel.

[152] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. x, 88.

[153] Ibid.

[154] Ibid.

[155] Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.

[156] *Id.*, at Section C.1.

[157] *Id.*, at Section C.3.

AWSS system and on other available water supply sources to fight fires in emergencies. It also requires coordinated, *annual* training on emergency operation of the system.

In 2017, the SFPUC updated its Emergency Response Plan.[158] A review of the Plan, however, offers little detail on the type of exercise conducted or how often exercises might be conducted in the future.[159] Similarly, although CS-199 identified the need for emergency training and a training exercise, CS-199 did not provide details as to the scope or frequency of any training exercises.

In the past several years the SFFD and SFPUC have taken advantage of many opportunities for joint training concomitant with their joint operation and maintenance of AWSS assets. For example, the two agencies test Pump Stations 1 and 2, on a monthly basis. The agencies also meet after greater-alarm fires to discuss coordination, and how to improve operations in the field. In addition, the SFFD and SFPUC have, on occasion, conducted joint emergency trainings involving earthquake disaster scenarios. In 2018, for example, they engaged in a "tabletop exercise" where high-level staff members were asked to respond to a hypothetical earthquake scenario to test their understanding of the emergency command structure.

The SFPUC anticipates that it will repeat this joint tabletop exercise at least every other year, and that it will conduct larger-scale simulations of post-earthquake emergency response procedures with the SFFD within the next two years. There is no formal document, however, outlining specific joint exercises or drills to be conducted by the two agencies.

In the 1989 Loma Prieta earthquake, human error was cited by some as a reason why AWSS was not available to fight fires in the Marina.[160] A 2011 survey of California fire and water agencies concluded, generally speaking, that "[f]ire and water department liaison is not very good" and that "[e]mergency firefighting water supply is not a focus."[161] Moreover, the report found that fire departments are not "regularly drilled for the very difficult task of moving water from the alternative water sources to the fire scene."[162]

The Civil Grand Jury believes that the City would be well served if the SFPUC and SFFD worked together to design and implement annual "hands-on" drills to make certain that their staff is prepared to use all available resources to fight fires after an earthquake. Accordingly, the Civil Grand Jury recommends that the MOU between the SFPUC and the SFFD be amended to include a more detailed roadmap for emergency response exercises to be held, City-wide,

---

158 Information provided by SFPUC.

159 City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

160 See, e.g., Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992).

161 PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 75. By contrast, both the SFPUC and the SFFD have indicated that they currently enjoy excellent communication.

162 *Id.*

annually. In addition to tabletop scenarios, these exercises should include hands-on field testing in the operation of AWSS assets and PWSS units.

CONCLUSION

Over one hundred years ago, our City was destroyed by fire following an earthquake. Luckily, our predecessors learned from this catastrophe. They aggressively undertook to design, fund, and quickly build a supplemental emergency water supply system that provided firefighters with multiple options if one or more water sources were compromised – "belt and suspenders." They gave us an excellent emergency water system to protect our wonderful, seismically vulnerable City.

We have, however, long outgrown the protective reach of the system we inherited. Now it is our turn to aggressively implement measures to extend protections to reach all San Francisco neighborhoods. The time to act is now, before it is too late.

FINDINGS

F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.

F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.

F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.

F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.

F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.

F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.

F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.

F8. Redundancy is an important feature of an emergency firefighting water system.

F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.

F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.

F11. The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.

F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.

F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.

RECOMMENDATIONS

R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.

R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.

R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.

R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.

R6. The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.

R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.

R9. By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.

R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the Civil Grand Jury requests responses as follows:

From the following City and County agencies and departments within 60 days:

- Office of the Mayor
    - Findings 4, 5, 6, and 11
    - Recommendations 1, 2, 4, and 8
- General Manager, San Francisco Public Utilities Commission
    - Findings 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13
    - Recommendations 1, 2, 6, 7, 9, and 10
- Chief, San Francisco Fire Department
    - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 13
    - Recommendations 1, 2, 4, 5, 6, 7, and 10
- Office of the City Administrator
    - Findings 6 and 11
    - Recommendations 1, 2 and 8
- Chief Resilience Officer, Office of the City Administrator
    - Findings 6 and 11
    - Recommendations 1, 2 and 8
- Director, San Francisco Department of the Environment
    - Recommendation 6
- Budget and Legislative Analyst Office, Board of Supervisors
    - Findings 6 and 11
    - Recommendation 3

From the Board of Supervisors and other governing bodies within 90 days:

- Board of Supervisors
    - Findings 4, 5, 6 and 11
    - Recommendations 1, 2, 3, 4, 6, 7, and 8
- San Francisco Public Utilities Commission
    - Findings 2, 4, 5, 6, 8, 9, 10, 11, and 12
    - Recommendations 1, 2, 6, 7, 9, and 10
- San Francisco Fire Commission
    - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11
    - Recommendations 1, 2, 4, 5, 6, 9 and 10

GLOSSARY AND TABLE OF ACRONYMS AND ABBREVIATIONS

ATC	Applied Technology Council. A non-profit corporation whose mission is to develop and promote state-of-the-art, user-friendly engineering resources and applications for use in mitigating the effects of natural and other hazards on the built environment, and which prepared reports in 2010 for the City under the CAPSS Project.
AWSS	Auxiliary Water Supply System. An independent emergency firefighting system built after the 1906 earthquake. The AWSS at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations. The AWSS HP pipelines can supply water at pressures up to 300 psi via hydrants with black, red or blue tops, depending upon location.
CAPSS	Community Action Plan for Seismic Safety. According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts.
CCSF	City and County of San Francisco
CDD	City Distribution Division. The division of the SFPUC responsible for maintenance of both the MWSS and the AWSS.
DWSS	Domestic Water Supply System, also referred to as the Municipal Water Supply System, MWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS (DWSS) is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
ERDIP	Earthquake Resistant Ductile Iron Pipe. A modern type of pipe that is believed to be earthquake resistant and that has been subjected to several major earthquakes in Japan without any observed failures.
EFWS	Emergency Firefighting Water System. All emergency sources of water and the means for delivering them. Includes HP AWSS pipelines, cisterns, PWSS and fireboats.
ESER	Earthquake Safety and Emergency Response. ESER bonds are generally issued every five to seven years to address to fund repairs and improvements to infrastructure that allow the City to respond more quickly and effectively to a major earthquake or other disaster.

FRA	Fire Response Area. The SFFD divides the City into 46 areas for initial alarm response, referred to as Fire Response Areas or FRAs.
HP	High-pressure
LOS	Level of Service
MOU	A Memorandum of Understanding between the SFPUC and the SFFD Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.
MWSS	Municipal Water Supply System, also referred to as the Domestic Water Supply System, DWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
PEER	Pacific Earthquake Engineering Research Center
PSI	Pounds per square inch
PWSS	Portable Water Supply System. A mobile above-ground large (five-inch) diameter hose system transported on trucks (hose tenders). A hose tender truck can carry approximately 5000 feet of five-inch hose. A more thorough description is provided at pages 23-26. The PWSS is not to be confused with the flexible water supply system, an idea for 12-inch diameter hoses that was abandoned as impractical.
SCADA	Supervisory Control and Data Acquisition. A computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
SFDPW	San Francisco Department of Public Works
SFFC	San Francisco Fire Commission
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
USGS	United States Geological Survey
WSIP	Water System Improvement Program. The WSIP is a $4.8 billion dollar, multi-year program to upgrade the SFPUC's regional and local water systems. The WSIP, which is over 96% complete, is one of the largest water infrastructure

programs in the nation and the largest infrastructure program ever undertaken by the City.

APPENDICES

A. Table of Findings and Recommendations
B. Table of Findings with Required Responses
C. Table of Recommendations with Required Responses
D. List of Reports Specifically Focusing on the City's AWSS or PWSS
E. List of Additional Reports Reviewed
F. USGS, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf
G. USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf
H. Map of Existing EFWS, with HP AWSS, Cisterns and other Assets
I. Map of Existing HP AWSS system
J. Map of SFFD Fire Response Areas
K. Abstract (page 2) from Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf
L. Analysis by the Ballot Simplification Committee of 1986 Proposition A.
M. San Francisco Fire Commission Resolution 2010-01, dated January 14, 2010, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf
N. SFPUC 2017 FAQ, https://sfwater.org/modules/showdocument.aspx?documentid=11507 printed March 6, 2019
O. SFPUC EFWS 2010 and 2014 ESER bond project status as of February 26, 2019
P. SFPUC Candidate EFWS Project list dated May 8, 2019
Q. Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990
R. Figure 5-1, *Preferred Alternative Planning Schedule*, from CS-199, at p. 71, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

APPENDIX A
TABLE OF FINDINGS AND RECOMMENDATIONS

Findings	Recommendations
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco. F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake. F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake. F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake. F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake. R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034. R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

Findings	Recommendations
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced seismically safe emergency water supply can be developed in those areas.	R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.
F8. Redundancy is an important feature of an emergency firefighting water system. F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

Findings	Recommendations
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

APPENDIX B
TABLE OF FINDINGS WITH REQUIRED RESPONSES

Findings	Required Responses
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	• Chief, San Francisco Fire Department • San Francisco Fire Commission • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Chief, San Francisco Fire Department • San Francisco Fire Commission
F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	• Chief, San Francisco Fire Department • San Francisco Fire Commission
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F8. Redundancy is an important feature of an emergency firefighting water system.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	• General Manager, San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department

APPENDIX C
TABLE OF RECOMMENDATIONS WITH REQUIRED RESPONSES

Recommendations	Required Responses
R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short-term and the long-term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	• Board of Supervisors • Budget and Legislative Analyst Office, Board of Supervisors

Recommendations	Required Responses
R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	• Office of the Mayor • Board of Supervisors • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Director, San Francisco Department of the Environment
R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above the median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department
R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034	• Office of the Mayor • Board of Supervisors • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator

Recommendations	Required Responses
R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

APPENDIX D
List of Reports Specifically Focusing On the City's AWSS or PWSS

2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf

AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report) (February 2014) ("CS-199"), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, prepared for SFPUC (February 2014), https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907

AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015) ("CS-229"), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246

AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report (January 5, 2018) ("2018 Westside Options Analysis"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found online at http://www.sfearthquakesafety.org/eser-reports.html

Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7

Metcalf & Eddy / AECOM, Auxiliary Water Supply System (AWSS) Study, prepared for Capital Planning Committee, City and County of San Francisco (2009) ("Metcalf & Eddy"), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00

San Francisco Department of Public Works, Auxiliary Water Supply System (AWSS) Pipeline Assessment, Earthquake Safety and Emergency Response Bond 2010, prepared for SFPUC (May 11, 2017), https://sfpuc.sharefile.com/share/view/684778cd4b46406e

Scawthorn, C., January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis", (Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC

APPENDIX E
List of Additional Reports Reviewed

Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010)("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf

Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety, prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project (2010), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517

Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018)

City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019

Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf

Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf

Kearns, F. and Moritz, M., How fierce fall and winter winds help fuel California fires, *The Conversation* (16 November, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985

Li, W., Wang, D., and Zhao, K., Research on Urban Post-earthquake Fire, presented at Sixth China-Japan-U.S. Trilateral Symposium on Lifeline Earthquake Engineering (2013) https://ascelibrary.org/doi/10.1061/9780784413234.008

Moritz, M., *California Needs To Rethink Urban Fire Risk, Starting with Where It Builds Houses*, in The Conversation (December 13, 2017), https://theconversation.com/california-needs-to-rethink-urban-fire-risk-starting-with-where-it-builds-houses-88825

O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996)

San Francisco Fire Department Emergency Operations Plan

San Francisco Fire Department Water Supplies Manual (2008), http://ufsw.org/pdfs/water_supplies_manual.pdf

Scawthorn, C., Coordinated Planning and Preparedness for Fire Following Major Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2013), https://ssc.ca.gov/forms_pubs/webpeer-2013-23-scawthorn.pdf

Scawthorn, C., Water Supply In Regards to Fire Following Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf

Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf

Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf or for a copy, click here.

Scawthorn, C., Fire Following Earthquake Aspects of the Southern San Andreas Fault M_W 7.8 Earthquake Scenario. *Earthquake Spectra* 27 (2), 419-441 (2011), http://www.sparisk.com/pubs/Scawthorn-2011-ShakeOut-FFE.pdf

Scawthorn, C., *Fire Following Earthquake, Supplemental Study for the ShakeOut Scenario.* The ShakeOut Scenario: U.S. Geological Survey Open File Report 2008-1150, California Geological Survey Preliminary Report 2, version 1.0, U.S. Geological Survey Circular 1324, California Geological Survey Special Report 207 version 1.0. U. S. Geological Survey and California Geological Survey, Pasadena (2008), Scawthorn-2008-ShakeOut-FFE

Scawthorn, C., Fire Following the M_w 7.0 HayWired Earthquake Scenario, in Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Engineering Implications*. Scientific Investigations Report 2017–5013–I–Q. Reston, VA: United States Geological Survey, ch. P, pp. 367-400 (2018), at https://doi.org/10.3133/sir20175013 and www.sparisk.com/pubs/HayWired-2018-vol2.pdf

Scawthorn, C., O'Rourke, T. D. & Blackburn, F. T., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*. Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf.

Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

U.S. Geological Survey, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf

U.S. Geological Survey, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf

Appendix F

UCERF3: A New Earthquake Forecast for California's Complex Fault System

With innovations, fresh data, and lessons learned from recent earthquakes, scientists have developed a new earthquake forecast model for California, a region under constant threat from potentially damaging events. The new model, referred to as the third Uniform California Earthquake Rupture Forecast, or "UCERF3" (http://www.WGCEP.org/UCERF3), provides authoritative estimates of the magnitude, location, and likelihood of earthquake fault rupture throughout the state. Overall the results confirm previous findings, but with some significant changes because of model improvements. For example, compared to the previous forecast (UCERF2), the likelihood of moderate-sized earthquakes (magnitude 6.5 to 7.5) is lower, whereas that of larger events is higher. This is because of the inclusion of multifault ruptures, where earthquakes are no longer confined to separate, individual faults, but can occasionally rupture multiple faults simultaneously. The public-safety implications of this and other model improvements depend on several factors, including site location and type of structure (for example, family dwelling compared to a long-span bridge). Building codes, earthquake insurance products, emergency plans, and other risk-mitigation efforts will be updated accordingly. This model also serves as a reminder that damaging earthquakes are inevitable for California. Fortunately, there are many simple steps residents can take to protect lives and property.

What is UCERF3?

California is sandwiched between the Pacific and North American tectonic plates, with the former migrating northwest about two inches per year compared to the latter. The plate boundary is far from smooth, reflecting more of a fragmented zone locked in a tectonic battle over which areas will give way, producing some of the steepest mountain ranges in the world. The sliding between plates is also not steady, but rather plays out in fits and starts with periods of rest interrupted by sudden slip along cracks in the Earth. These "fault ruptures" in turn cause the ground to shake, much like the ripples that radiate from a pebble tossed in a pond, and it is this shaking that causes the most damage in earthquakes.

Two kinds of scientific models are used to help safeguard against earthquake losses: an Earthquake Rupture Forecast, which tells us where and when the Earth might slip along the state's many faults, and a Ground Motion Prediction model, which estimates the subsequent shaking given one of the fault ruptures. UCERF3 is the first type of model, representing the latest earthquake-rupture forecast for California. It was developed and reviewed by dozens of leading scientific experts from the fields of seismology, geology, geodesy, paleoseismology, earthquake physics, and earthquake engineering. As such, it represents the best available science with respect to authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes throughout the state (further background on these models, especially with respect to ingredients, can be found in U.S. Geological Survey Fact Sheet 2008–3027, http://pubs.usgs.gov/fs/2008/3027/).

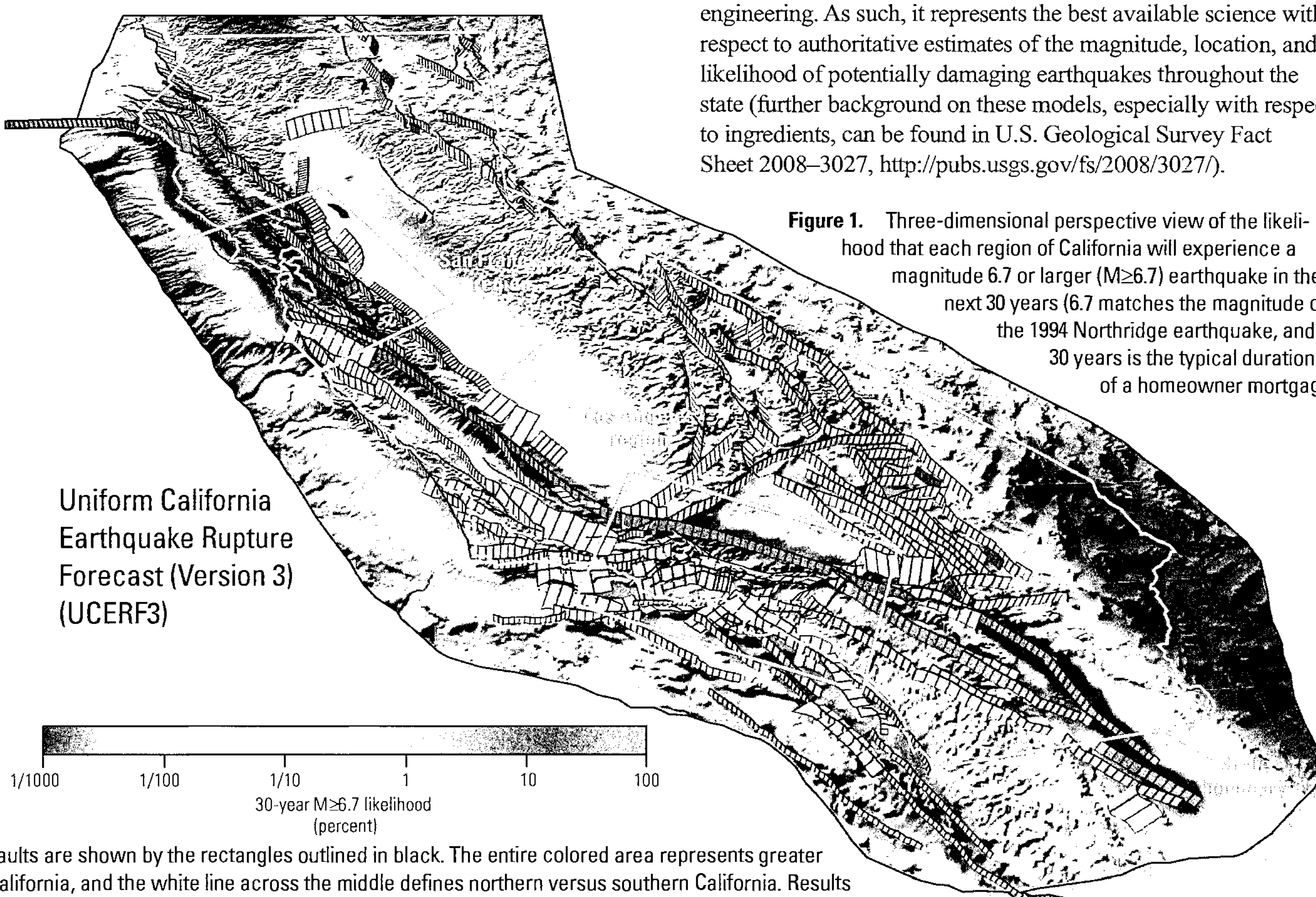


Figure 1. Three-dimensional perspective view of the likelihood that each region of California will experience a magnitude 6.7 or larger (M≥6.7) earthquake in the next 30 years (6.7 matches the magnitude of the 1994 Northridge earthquake, and 30 years is the typical duration of a homeowner mortgage). Faults are shown by the rectangles outlined in black. The entire colored area represents greater California, and the white line across the middle defines northern versus southern California. Results do not include earthquakes on the Cascadia Subduction Zone, a 750-mile offshore fault that extends about 150 miles into California from Oregon and Washington to the north.

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20153009
Fact Sheet 2015–3009
March 2015

Fault Model Evolution

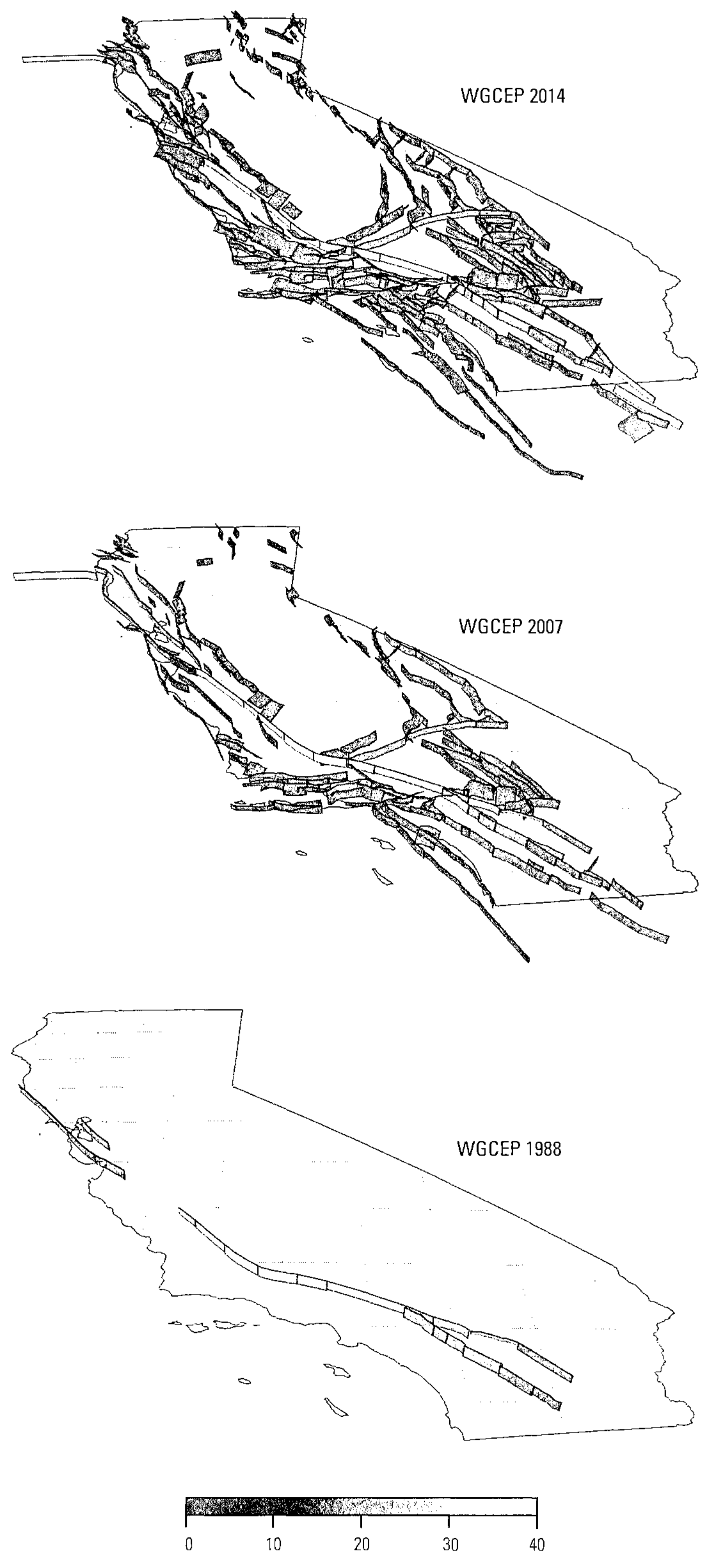


Figure 2. Changes with time of the inventory of faults used in California earthquake forecast models (WGCEP, Working Group on California Earthquake Probabilities).

Why a New Earthquake Forecast Model?

All scientific models, including earthquake rupture forecasts, are an approximation of the physical system they represent, in the same way that "the map is not the actual territory" (Korzbski, 1931). UCERF3 represents the latest model from the Working Group on California Earthquake Probabilities (WGCEP) (WGCEP, 2014), which also released forecasts in 1988, 1990, 1995, 2003, and 2007. This historical progression of models reflects increasingly accurate, detailed, and sophisticated representations of a particularly complex natural system.

A puzzling feature of previous models has been a forecasted rate of moderate-sized earthquakes (between magnitude 6.5 and 7.0) that is up to a factor of two higher than that observed historically. The first discovery of this discrepancy, by the 1995 WGCEP, was particularly disturbing in that one such event, the magnitude 6.7 1994 Northridge earthquake, had just surprised many as the costliest earthquake in U.S. history. In fact, the prospect of such events becoming more frequent contributed to an ensuing homeowner-insurance-availability crisis, as most insurance providers opted to pull out of the market altogether, rather than comply with a state law requiring they offer an earthquake option with each policy. This insurance availability crisis was ultimately solved in 1996 with the legislative creation of the California Earthquake Authority (http://www.earthquakeauthority.com), which has since become the largest earthquake insurance provider in the state. However, the discrepancy between the forecast rate and the observed rate at moderate magnitudes has remained through the most recent previous study (WGCEP, 2007), and scientists have hotly debated whether this is real or a result of some model limitation.

Recent earthquakes have fortunately provided clues. For example, the Northridge earthquake occurred on a previously unrecognized fault, which motivated scientists to search for other faults and quantify those that might be capable of producing damaging earthquakes. The effort has paid off. Whereas the 1988 WGCEP considered only 16 different faults, albeit the main ones, by the time of the WGCEP 2007 effort there were about 200. With UCERF3, there are now more than 350 fault sections in the model, thanks in part to using space-based geodesy where geologic data are limited. This historical progression is shown in the fault model evolution figure at left.

Another clue with respect to the moderate-magnitude rate discrepancy is that many recent earthquakes have plowed past previously inferred fault-rupture boundaries. That is, past models have generally assumed that earthquakes are either confined to separate faults, or that long faults like the San Andreas can be divided into different segments that only rupture separately. However, all three of the most-recent, largest earthquakes in California ruptured right past such boundaries, jumping from one fault to another as multifault ruptures. These were the 1992 magnitude 7.3 Landers, the 1999 magnitude 7.2 Hector Mine, and the 2010 magnitude 7.2 El Mayor–Cucapah earthquakes. The 2011 magnitude 9.0 Tohoku, Japan earthquake also violated previously defined fault-segment boundaries, resulting in a much larger fault-rupture area and magnitude than expected, and contributing to the deadly tsunami and Fukushima nuclear disaster.

Given these observations, the possibility of multifault ruptures clearly needed to be considered in our new model. In fact, as the inventory of California faults has grown over the years, it

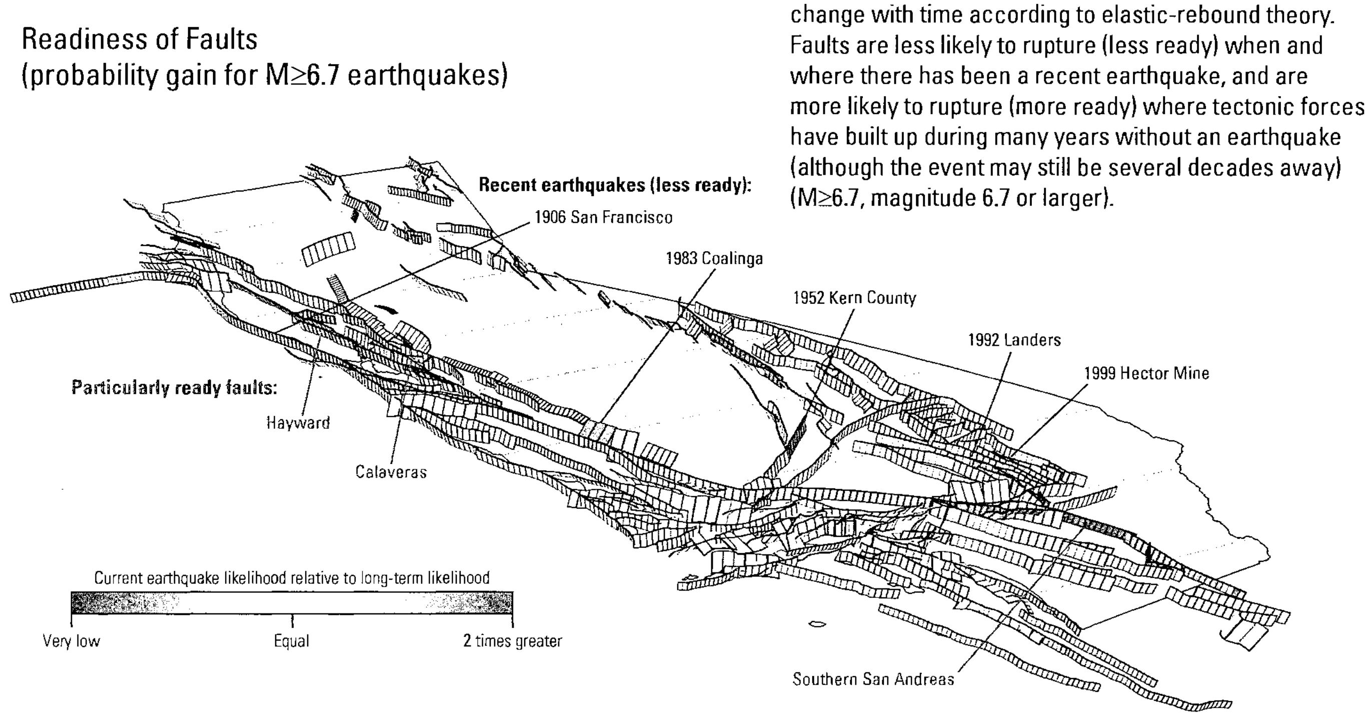


Figure 3. California earthquake likelihood in UCERF3 incorporates the concept that earthquake probabilities change with time according to elastic-rebound theory. Faults are less likely to rupture (less ready) when and where there has been a recent earthquake, and are more likely to rupture (more ready) where tectonic forces have built up during many years without an earthquake (although the event may still be several decades away) (M≥6.7, magnitude 6.7 or larger).

has become increasingly apparent that we are not dealing with a few well-separate faults, but with a vast interconnected fault system. In fact, it has become difficult to identify where some faults end and others begin, implying many more opportunities for multifault ruptures. As a consequence, UCERF3 now considers more than 250,000 different fault-based earthquakes, including multifault ruptures, whereas UCERF2 had about 10,000, and previous models had far fewer. Because we still lack a complete inventory of faults, UCERF3 (and UCERF2 before it) also includes the possibility of earthquakes on unrecognized faults elsewhere in the region.

Solving for the rate of all possible ruptures in the interconnected fault system represented a significant challenge. The UCERF3 methodological breakthrough, referred to as the "grand inversion," allowed us to not only solve for the rate of each earthquake rupture, but to also draw upon a broader range of observations in doing so. For example, the previous rate discrepancy at moderate-magnitudes was turned into part of the solution. That is, because the total plate-tectonic deformation is generally well known, any increase in the rate of larger, multifault ruptures must come with a consequent reduction in rates at lower magnitudes. The grand inversion manages the overall plate-tectonic, fault-system budget mathematically, adding whatever multifault ruptures are needed to eliminate the rate discrepancy at moderate magnitudes. So, not only does UCERF3 include the types of multifault ruptures seen in nature, but doing so has also eliminated the overprediction of moderate-sized events, implying the latter was simply a manifestation of the isolation and segmentation of faults in the previous models.

UCERF3 also includes the notion of fault "readiness," where earthquake likelihoods go down on faults that have recently ruptured, and build back up with time as tectonic stresses reaccumulate. Although this concept, known formally as Reid's elastic rebound theory (Reid, 1911), has been around for more than a century, applying it in a model that includes multifault ruptures also proved challenging. A new methodology was therefore developed, which also relaxes the requirement that the date-of-last event be known where applied. That is, we may not know when the most recent event occurred on many California faults, but we do know that it had to have been prior to 1875 (the year when reliable recordkeeping began). Being able to account for this "historic open interval" for events that precede 1875 allowed us to quantify fault readiness throughout the entire fault system (fig. 3), rather than being limited to only a subset of faults as in previous studies.

There are many uncertainties in both the data and scientific theories that go into UCERF3, and alternative values for each element can lead to a different forecast. Consequently, UCERF3 is not a single model, but rather a collection of 5,760 different viable models. The results presented in the next section represent an average of these forecasts. Calculating grand-inversion results for all the models required the use of super computers, as they would have taken more than 8 years on a single desktop computer.

What Are the Results, and How Do They Differ from Previous Estimates?

UCERF3 results for various regions and faults of interest are shown in the figures and tables here. How have expected earthquake rates changed from the previous model? Overall, the results confirm earlier findings (California is earthquake country), but with some important refinements in certain areas. Considering the entire region, the average time between magnitude 6.7 and larger earthquakes has gone from 1 every 4.8 years in UCERF2, to 1 about every 6.3 years in UCERF3, representing a 30 percent decrease in the new forecasted

Table 1. Average time between earthquakes in the various regions together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014). Values listed in parentheses indicate the factor by which the rates and likelihoods have increased, or decreased, since the previous model (UCERF2). "Readiness" indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes (see text). These values include aftershocks. It is important to note that actual repeat times will exhibit a high degree of variability, and will almost never exactly equal the average listed here.

Greater California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.12	(0.7)	100%	(1.0)	1.0
6	1.2	(0.9)	100%	(1.0)	1.0
6.7	6.3	(1.3)	>99%	(1.0)	1.0
7	13	(1.3)	93%	(1.0)	1.0
7.5	52	(1.0)	48%	(1.0)	1.1
8	494	(0.8)	7%	(1.5)	1.2

Southern California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.3	(0.9)	100%	(1.0)	1.0
6.7	12	(1.5)	93%	(1.0)	1.0
7	25	(1.4)	75%	(0.9)	1.1
7.5	87	(1.2)	36%	(0.9)	1.2
8	522	(0.4)	7%	(2.5)	1.3

Northern California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.4	(0.9)	100%	(1.0)	1.0
6.7	12	(1.2)	95%	(1.0)	1.0
7	25	(1.2)	76%	(1.0)	1.1
7.5	92	(0.9)	28%	(1.1)	1.0
8	645	(0.8)	5%	(1.4)	1.1

San Francisco region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.3	(0.7)	100%	(1.0)	1.0
6	8.9	(1.0)	98%	(1.0)	1.0
6.7	29	(1.1)	72%	(1.1)	1.1
7	48	(0.9)	51%	(1.3)	1.1
7.5	124	(0.7)	20%	(1.6)	0.9
8	825	(0.7)	4%	(1.9)	1.0

Los Angeles region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.4	(0.6)	100%	(1.0)	1.0
6	10	(1.1)	96%	(1.0)	1.0
6.7	40	(2.1)	60%	(0.8)	1.1
7	61	(2.0)	46%	(0.7)	1.2
7.5	109	(1.3)	31%	(0.9)	1.3
8	532	(0.4)	7%	(2.5)	1.3

rate (and note that most of these events occur in remote areas of the state). For magnitude 8 and larger, on the other hand, the rate has increased by 20 percent in UCERF3, with an expected repeat time of 494 years for UCERF3, down from 1 every 617 years in UCERF2. These changes are a direct and expected manifestation of including multifault ruptures in UCERF3. A more careful analysis of historical seismicity has also produced an increased rate for magnitude 5 and greater earthquakes, going from about 5.8 per year in UCERF2 to 8.3 per year in UCERF3. All of these trends are similar to those seen in various subregions of the state, with differences being slightly more dramatic for the Los Angeles area because that region has a large number of faults that can now host multifault ruptures.

Results are also expressed in terms of the likelihood of experiencing one or more earthquakes in the next 30 years, the duration of a typical home mortgage, and these values also take fault readiness into consideration (how long it has been since the most recent event). As in UCERF2, the likelihood for magnitude 6.7 and larger earthquakes somewhere in the entire region remains near certainty (greater than 99 percent). The likelihood is 7 percent for magnitude 8 and greater, a 50 percent increase over UCERF2, resulting from both the inclusion of multifault ruptures and the particular readiness of some large faults.

One particularly ready fault is the Southern San Andreas, which contributes to its continued status of being the most likely to host a large earthquake. Specifically, it has a 19 percent chance of having one or more events larger than magnitude 6.7 in the next 30 years near Mojave, Calif. The comparably low values for the Northern San Andreas, such as 6.4 percent near San Francisco, are partly because of the relatively recent 1906 earthquake on that fault. In fact, probabilities on two other Bay Area faults, the Hayward–Rodgers Creek and the Calaveras, currently rival or exceed those on the Northern San Andreas, in part because they are both relatively ready.

Compared to the previous model, UCERF2, the San Jacinto fault has a three-fold decrease in the likelihood of magnitude 6.7 or larger earthquakes. Much of this decrease is because of the inclusion of more multifault ruptures, as indicated by the factor of 57 increase in the likelihood of magnitude 8 and larger earthquakes. In other words, the fault has traded some moderate-sized events for rare larger ones.

The Calveras fault, on the other hand, has a three-fold increase in the likelihood of magnitude 6.7 or larger earthquakes. In UCERF2 most Calaveras events were well below magnitude 6.7, so the inclusion of multifault ruptures in UCERF3 has increased the frequency of earthquakes above magnitude 6.7.

We have only touched on a few of the more important changes between UCERF2 and UCERF3, and have highlighted only some of the influential factors. Many more are currently understood, and scientists will be further analyzing results and testing assumptions for years to come.

So what do these changes imply with respect to seismic hazard, the likelihood of ground shaking, as well as for seismic risk, the threat to the built environment with respect to fatalities and economic losses? The answer turns out to be entirely dependent on what you are concerned about. For example, increasing the likelihood of large multifault earthquakes, which consequently reduces the likelihood of moderate-sized events, may increase the risk to tall buildings or large bridges, but actually lower the risk to residential homes.

As a consequence, it is difficult to make generalizations about the hazard or risk implications of UCERF3 without first specifying both asset types and their locations. Conclusions will vary depending on whether you are designing a single family dwelling in Sacramento, retrofitting the San Francisco–Oakland Bay Bridge, considering the location of a nuclear power plant, laying pipeline across the San Andreas Fault, or considering aggregate losses over a large insurance portfolio. The practical implications will need to be considered on a case-by-case basis.

What Next?

UCERF3 can now be used to evaluate seismic hazard and risk in California. In fact, it has already been used for the 2014 update of the U.S. Geological Survey National Seismic Hazard Maps (http://earthquake.usgs.gov/hazards/), which in turn are used in building codes. The California Earthquake Authority, which is required by law to use the best available science, will use UCERF3 to evaluate insurance premiums charged to customers, as well as their own level of reinsurance. UCERF3 will be used in many other risk mitigation

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

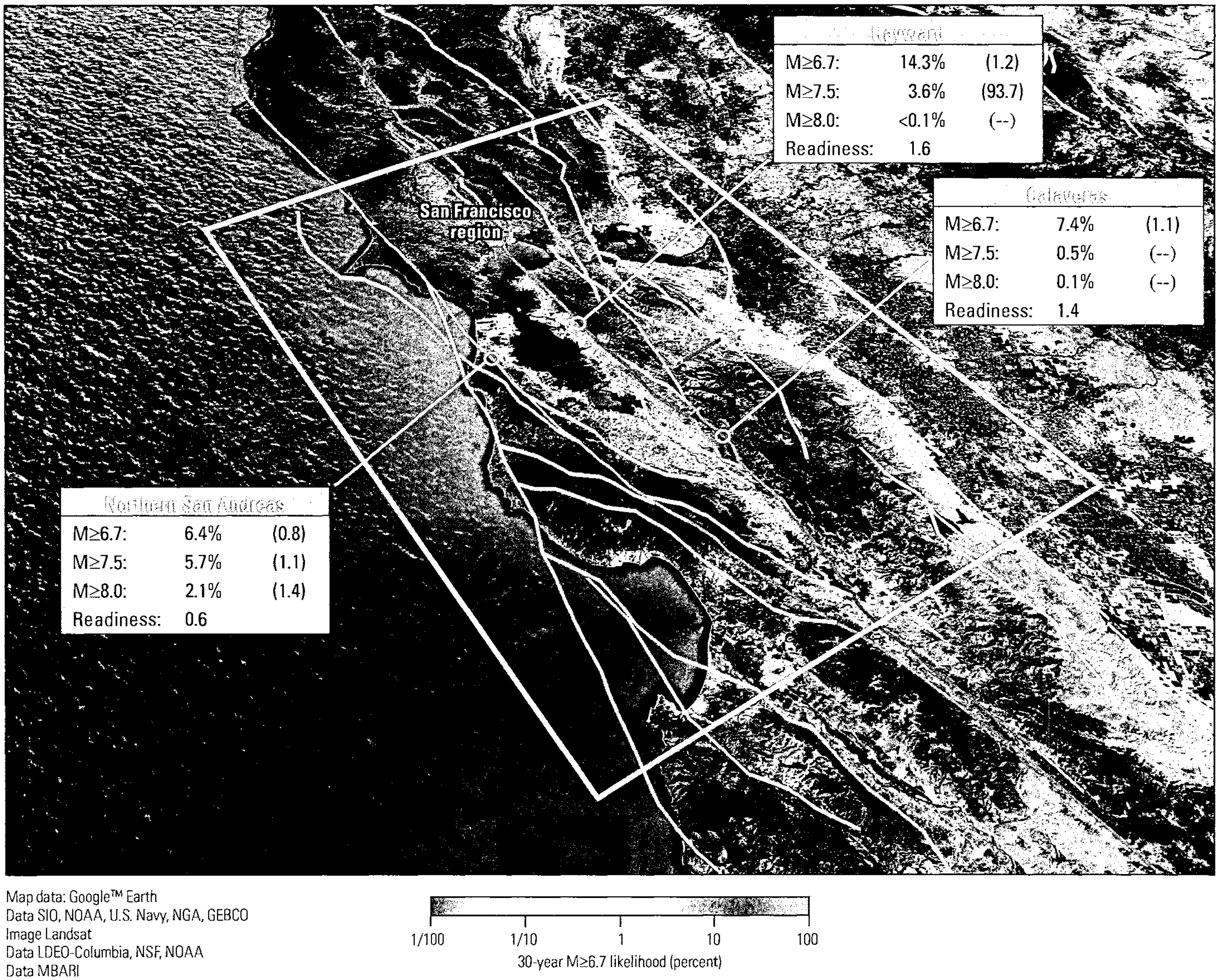


Figure 4. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near San Francisco, Calif.

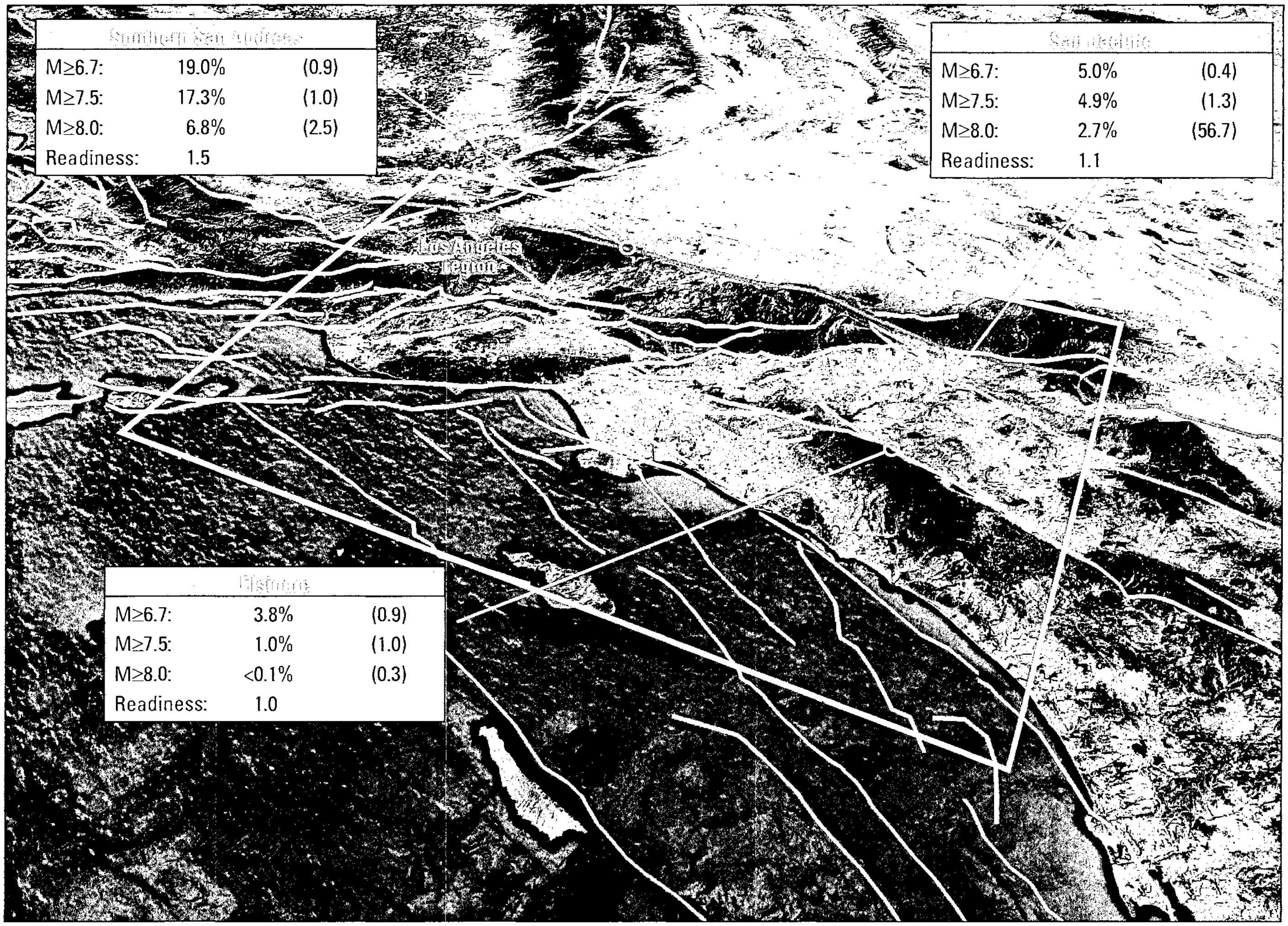
efforts in the years to come, including engineering design of buildings and lifelines, loss estimation for catastrophic bonds and other risk-linked securities, and emergency preparedness, all of which have the ultimate goal of increasing public safety and community resilience.

UCERF3 should also serve as a reminder that California is earthquake country, and residents should always be prepared. Simple safeguards include practicing "drop, cover, and hold on," securing items in your home and workplace that could fall during an earthquake, and storing seven-days worth of food and water. Homeowners can also consider structural retrofits, such as bolting the house to its foundation, as well as earthquake insurance options. For further guidance on how to prepare for, survive, and recover after big earthquakes, follow the Seven Steps to Earthquake Safety (http://www.earthquakecountry.org/sevensteps).

Although UCERF3 is a clear improvement over the previous model (UCERF2), it is still an approximation of the natural system. For example, it does not model the earthquake-triggering process that produces aftershocks, even though we know such events can be large and damaging. Through the National Earthquake Hazard Reduction Program (http://www.nehrp.gov), the U.S. Geological Survey and its partners will continue to conduct research aimed at improving our understanding of fault behavior and estimates of earthquake hazard in the future.

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]



M≥6.7:	19.0%	(0.9)
M≥7.5:	17.3%	(1.0)
M≥8.0:	6.8%	(2.5)
Readiness:	1.5	

M≥6.7:	5.0%	(0.4)
M≥7.5:	4.9%	(1.3)
M≥8.0:	2.7%	(56.7)
Readiness:	1.1	

M≥6.7:	3.8%	(0.9)
M≥7.5:	1.0%	(1.0)
M≥8.0:	<0.1%	(0.3)
Readiness:	1.0	

Map data: Google™ Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Data LDEO-Columbia, NSF, NOAA
Data MBARI

Figure 5. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near Los Angeles, Calif.

References

Korzybski, A. 1931, A non-Aristotelian System and its necessity for rigour in mathematics and physics: presention at the American Mathematical Society, December 28, 1931, New Orleans, Louisiana, meeting of the American Association for the Advancement of Science. Reprinted in Science and Sanity, 1933, p. 747–61.

Reid, H.F., 1911, The elastic-rebound theory of earthquakes: University of California Publications, Bulletin of the Department of Geological Sciences v. 6, p. 413–444.

Working Group on California Earthquake Probabilities, 2007, Published as: Field, E.H., Dawson, T.E., Felzer, K.R., Frankel, A.D., Gupta, V., Jordan, T.H., Parsons, T., Petersen, M.D., Stein, R.S. Weldon, II, R.J., and Wills, C.J., 2009, Uniform California earthquake rupture forecast, Version 2 (UCERF 2): Bulletin of the Seismological Society of America, v. 99, p. 2053–2107, doi:10.1785/0120080049.

Working Group on California Earthquake Probabilities, in press, Published as: Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R. Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C. Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J. II, , and Zeng, Y., 2015, Long-term, time-dependent probabilities for the third uniform California earthquake rupture forecast (UCERF3), Bulletin of the Seismological Society of America.

—*Authors: Edward H. Field and members of the 2014 WGCEP*

Cooperating organizations:
Southern California Earthquake Center (SCEC)
California Geological Survey (CGS)
California Earthquake Authority
U.S. Geological Survey

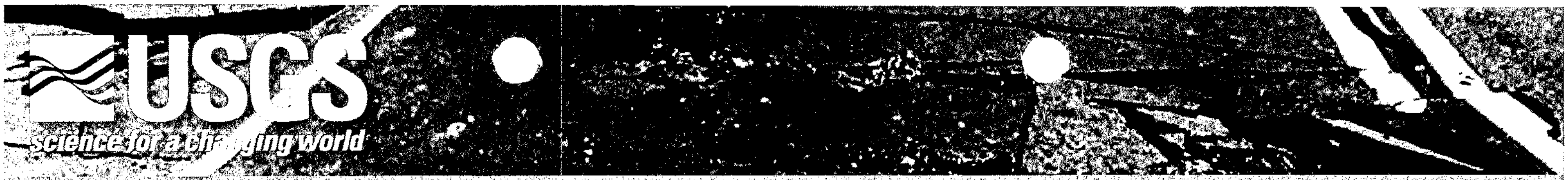
Additional Resources:

For general earthquake information contact:
1-888-ASK-USGS (1-888-275-8747)
http://earthquake.usgs.gov/
http://ask.usgs.gov
or
SCEC Education and Outreach: 213-740-3262

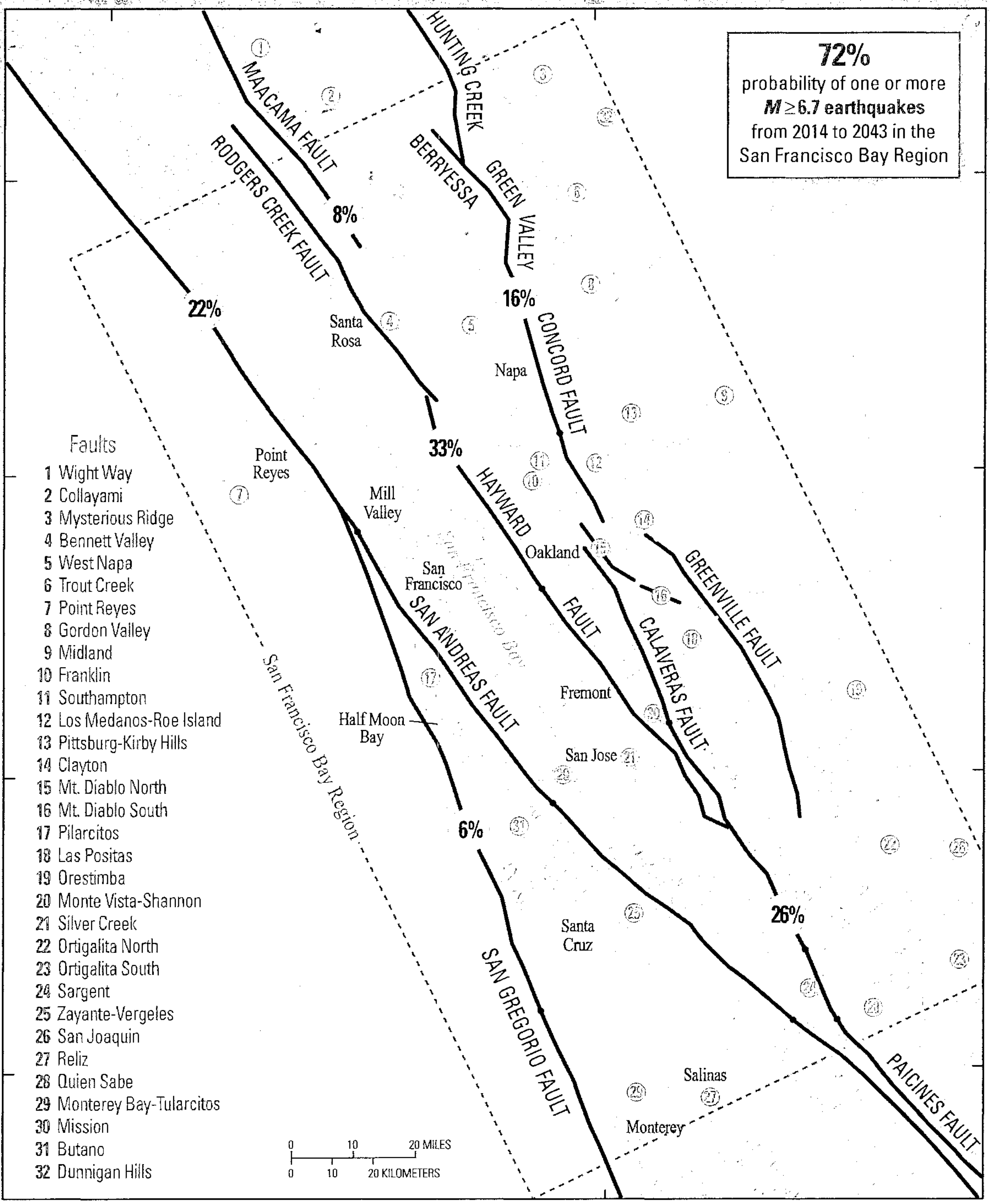
For UCERF3 information see:
http://www.WGCEP.org/UCERF3

For technical questions contact:
Edward (Ned) Field: field@usgs.gov

Appendix G



Earthquake Outlook for the San Francisco Bay Region 2014–2043



EXPLANATION

Major plate boundary faults

(3) Lesser-known smaller faults

Urban areas

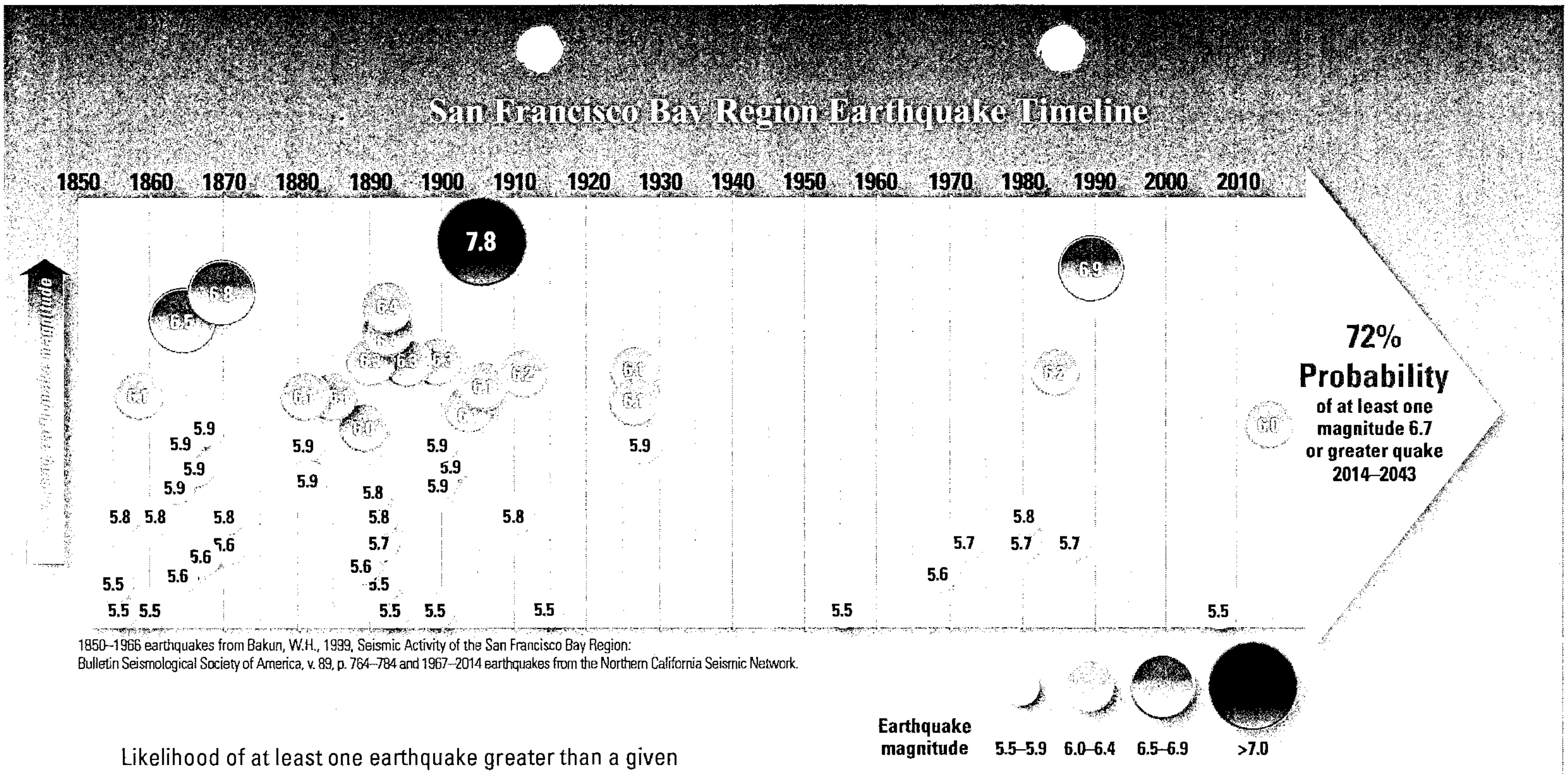
Map of known active faults in the San Francisco Bay region. The 72 percent probability of a magnitude 6.7 or greater earthquake includes the well-known major plate-boundary faults, lesser-known faults, and unknown faults. The percentage shown within each colored circle is the probability that a magnitude 6.7 or greater earthquake will occur somewhere on that fault system by the year 2043. The probability that a magnitude 6.7 or greater earthquake will involve one of the lesser-known faults is 13 percent.

Using information from recent earthquakes, improved mapping of active faults, and a new model for estimating earthquake probabilities, the 2014 Working Group on California Earthquake Probabilities updated the 30-year earthquake forecast for California. They concluded that there is a 72 percent probability (or likelihood) of at least one earthquake of magnitude 6.7 or greater striking somewhere in the San Francisco Bay region before 2043. Earthquakes this large are capable of causing widespread damage; therefore, communities in the region should take simple steps to help reduce injuries, damage, and disruption, as well as accelerate recovery from these earthquakes.

Building damaged in 2014 South Napa earthquake. Photograph by Erol Kalkan, U.S. Geological Survey.

U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2016–3020
Revised August 2016 (ver. 1.1)



1850–1966 earthquakes from Bakun, W.H., 1999, Seismic Activity of the San Francisco Bay Region: Bulletin Seismological Society of America, v. 89, p. 764–784 and 1967–2014 earthquakes from the Northern California Seismic Network.

Timeline of magnitude 5.5 and greater earthquakes in the San Francisco Bay region 1850–2014. In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.

Likelihood of at least one earthquake greater than a given magnitude in the San Francisco Bay region between 2014 and 2043.

Magnitude (M)	30-year likelihood of at least one earthquake in the San Francisco Bay region
$M \geq 6.0$	98 percent
$M \geq 6.7$	72 percent
$M \geq 7.0$	51 percent
$M \geq 7.5$	20 percent

Earthquake Preparedness Helps

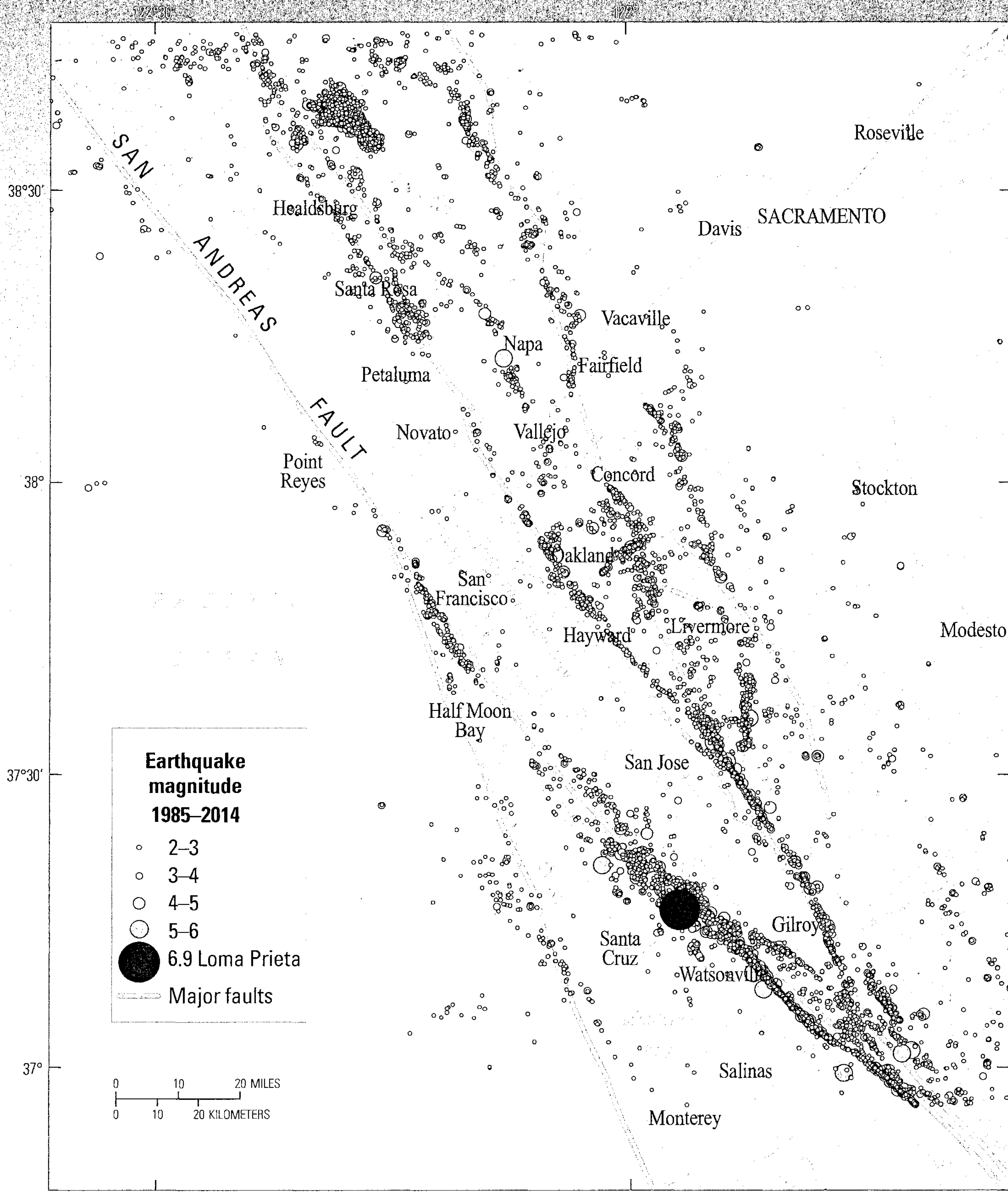
Early Sunday morning on August 24, 2014, the residents of Napa, California, were jolted awake by a strong, magnitude 6.0 earthquake. Within 30 minutes, the staff of Becoming Independent, a non-profit organization that helps adults with intellectual disabilities lead independent lives, called the people they serve in the affected area. The staff quickly visited all of the clients that needed help with cleanup and making their homes safe, a task made easier because both groups were trained in disaster preparedness and the clients had emergency kits with needed supplies on hand. The South Napa earthquake shifted houses off their foundations, damaged chimneys, started fires, and broke water mains throughout the city, causing hundreds of millions of dollars in economic losses. Many historic masonry buildings in downtown Napa were damaged. The earthquake was the largest in the San Francisco Bay region since the 1989 magnitude 6.9 Loma Prieta earthquake and a clear reminder of the seismic vulnerability of the region. The staff and clients of Becoming Independent showed that understanding and preparing for these events can improve how we live with future earthquakes.

Why Does the San Francisco Bay Region Have Earthquakes?

The same geologic process that is responsible for the San Francisco Bay region's beautiful coastlines, bays, hills, and valleys is also the primary driving force for earthquakes along faults in the region. The Bay region is located within the active boundary between the Pacific and the North American tectonic plates, where the Pacific plate slowly and continually slides northwest past the North American plate. The San Andreas Fault, on which two magnitude 7.8–7.9 earthquakes have occurred in historical time, including the 1906 San Francisco earthquake, is the fastest slipping fault along the plate boundary. Other major plate boundary faults in the San Francisco Bay region include the Hayward, Rodgers Creek, Calaveras, Maacama, San Gregorio, Concord, Green Valley, and Greenville Faults.

How Do Scientists Calculate Earthquake Probability?

Scientists rely upon a variety of techniques to help understand the rate and magnitude of past earthquakes in order to estimate the likelihood of future earthquakes. The Global Positioning System (GPS) and other land surveying and geologic techniques have allowed scientists to make more accurate measurements of how the current plate motions—totaling 1.6 inches per year across the San Francisco Bay region—distribute stress onto these individual faults. Balancing plate motions with the slip during large earthquakes and slow creep on faults allows scientists to calculate average rates of earthquake occurrence over periods of hundreds to thousands of years. (Continued on page 4)



Map of earthquakes greater than magnitude 2.0 in the San Francisco Bay region from 1985–2014. Small earthquakes occur on both major faults (shown by the gray lines) and minor faults (not shown). Because of the variability of fault geometry, earthquakes at depth do not always coincide with the mapped faults at the Earth's surface. There are sections of major faults, particularly the San Andreas Fault, with few or no small earthquakes but they will produce large earthquakes in the future. Compiled from the Northern California Seismic Network.

(Continued from page 2). A trench excavated across the Hayward Fault in Fremont revealed evidence of 12 large earthquakes over the past 1,900 years. The time interval between these earthquakes ranged from about 100 to 210 years. Historical records indicate that the most recent large earthquake on this fault occurred in 1868. However, detailed information about other past earthquakes in the San Francisco Bay region is difficult to obtain because seismograph records only go back to about 1900, historical accounts are sparse before 1850, and there are limited locations where faults can be trenched to identify and date prehistoric earthquakes.

Calculating accurate earthquake probabilities for short periods, such as 30 years, is also challenging. Although the 30-year time interval is convenient for humans, it is much less than the average time between large earthquakes on these faults, which can range from hundreds to thousands of years. The rate of large earthquakes in the San Francisco Bay region was high in the late 1800s but dropped abruptly after the 1906 San Francisco earthquake on the San Andreas Fault. Scientists believe that the post-1906 earthquake rate decreased because the large amount of slip along the San Andreas Fault in 1906 temporarily reduced the stress on many of the faults in the region. However, the ongoing motion of the tectonic plates began rebuilding stresses after the 1906 event, and earthquakes larger than magnitude 5.5 resumed during the second half of the 20th century. Future large, damaging earthquakes in the San Francisco Bay region, similar in size to the 1989 Loma Prieta and 1906 San Francisco earthquakes, may or may not be accompanied by the level of earthquake activity observed in the late 1800s.

The 2014 Uniform California Earthquake Rupture Forecast version 3 (http://pubs.usgs.gov/fs/2015/3009/) provides an updated estimate of the likelihood of large earthquakes in California over a 30-year time window from 2014 to 2043. The forecast accounts for how fast stress is accumulating on each fault due to plate motions and the time since its most recent large earthquake(s). In updating the probability calculations, scientists used a more complete set of faults for the San Francisco Bay region than those used in the previous (2008) calculations, adding 32 smaller faults to the 5 major fault systems. The new study has also incorporated more options for how multiple faults might rupture together in large earthquakes.

Probabilities of Earthquakes in the San Francisco Bay Region

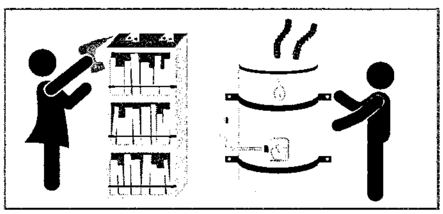
Smaller earthquakes occur more frequently than larger earthquakes. The probability that an earthquake of magnitude 6.0 or larger will occur before 2043 is 98 percent. The probability of at least one earthquake of magnitude 6.7 or larger in the San Francisco Bay region is 72 percent, and for at least one earthquake of magnitude 7.0 or larger it is 51 percent. These probabilities include earthquakes on the major faults, lesser-known faults, and unknown faults.

The probability of a large earthquake occurring on an individual fault in the San Francisco region is lower than the probability of an earthquake occurring anywhere in the region. The faults in the region with the highest estimated probability of generating damaging earthquakes between 2014 and 2043 are the Hayward, Rodgers Creek, Calaveras, and San Andreas Faults. In this 30-year period, the probability of an earthquake of magnitude 6.7 or larger occurring is 22 percent along the San Andreas Fault and 33 percent for the Hayward or Rodgers Creek Faults. Individual sections of these faults have lower probabilities for large earthquakes to occur (continued on page 6);

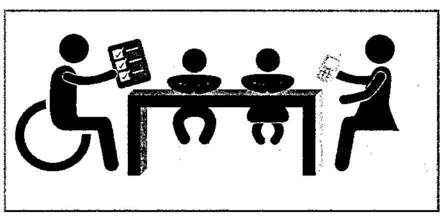
Seven Steps to Earthquake Safety

PREPARE

Before the next big earthquake we recommend these four steps that will make you, your family, or your workplace better prepared to survive and recover quickly:



Step 1: Secure your space by identifying hazards and securing moveable items.



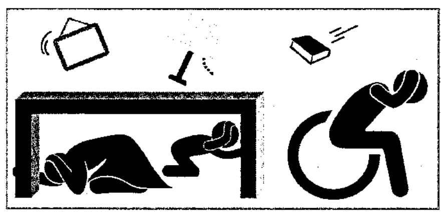
Step 2: Plan to be safe by creating a disaster plan and deciding how you will communicate in an emergency.

Step 3: Organize disaster supplies in convenient locations.

Step 4: Minimize financial hardship by organizing important documents, strengthening your property, and considering insurance.

SURVIVE

During the next big earthquake, and immediately after, is when your level of preparedness will make a difference in how you and others survive and can respond to emergencies:

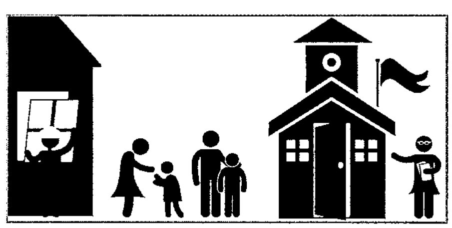


Step 5: Drop, Cover, and Hold On when the earth shakes.

Step 6: Improve safety after earthquakes by evacuating if necessary, helping the injured, and preventing further injuries or damage.

RECOVER

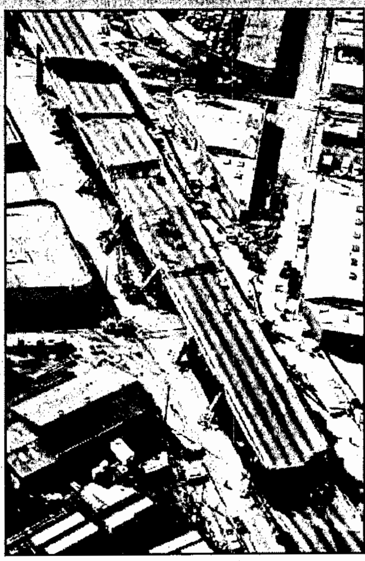
After the immediate threat of the earthquake has passed, your level of preparedness will determine your quality of life in the weeks and months that follow:



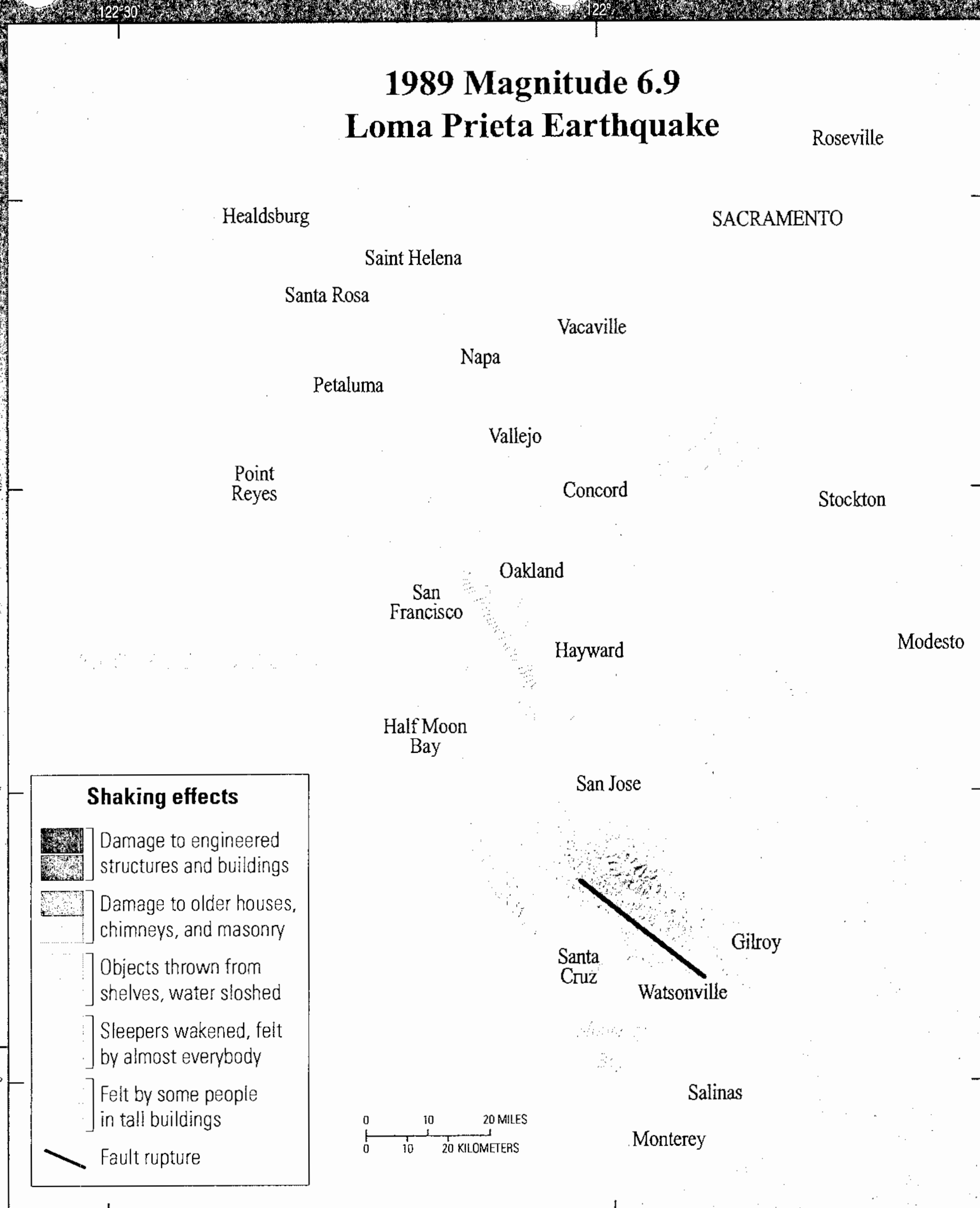
Step 7: Reconnect and Restore. Restore daily life by reconnecting with others, repairing damage, and rebuilding community.

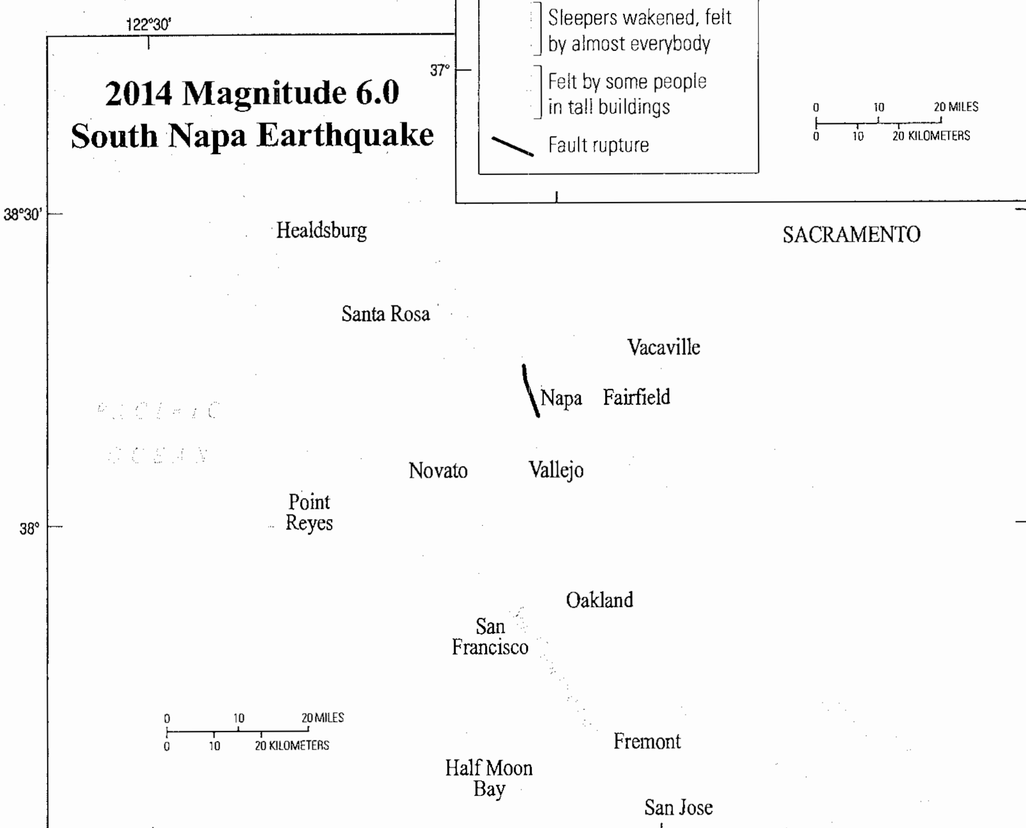
Adapted from Seven Steps To Earthquake Safety
http://earthquakecountry.org/sevensteps/

Maps showing intensity of ground shaking for the South Napa and Loma Prieta earthquakes. The black lines show the location of fault slip at depth. The maps illustrate how the area subjected to strong shaking increases with increasing earthquake magnitude.



Road damage from the Loma Prieta earthquake. Photograph by H.G. Wilshire, U.S. Geological Survey.





Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

Additional Earthquake Resources

American Red Cross – Bay Area (http://www.redcross.org/local/northern-california-coastal)
Association of Bay Area Governments (http://resilience.abag.ca.gov/earthquakes/)
Bay Area Earthquake Alliance (http://bayquakealliance.org/)
California Earthquake Authority (http://www.californiarocks.com/)
California Geological Survey
(http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes)
Did You Feel It? (http://earthquake.usgs.gov/earthquakes/dyfi/)
Earthquake Country Alliance (http://earthquakecountry.org/)
Putting Down Roots in Earthquake Country (http://pubs.usgs.gov/gip/2005/15/)
ShakeAlert – An Earthquake Early Warning System for the United States West Coast
(http://pubs.usgs.gov/fs/2014/3083/)
ShakeMap (http://www.cisn.org/shakemap/nc/shake/index.html)
ShakeOut.org (http://www.shakeout.org/california/bayarea/)
Uniform California Earthquake Rupture Fault version 3 Fact Sheet
(http://pubs.usgs.gov/fs/2015/3009/)
United Policyholders (http://www.uphelp.org/)
USGS Real-Time Earthquakes (http://earthquake.usgs.gov/earthquakes/map/)

Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

(continued from page 5) however, an earthquake of magnitude 6.7 or larger will cause strong shaking over a broad area. Therefore, it is important to estimate the probability of a large earthquake occurring anywhere in the San Francisco Bay region.

What is the Likelihood That an Earthquake Will Affect You?

Earthquake probabilities are only one component in the evaluation of earthquake hazards. Higher magnitude earthquakes have broader areas of intense shaking and cause more damage than lower magnitude earthquakes. In a magnitude 6.0 earthquake, strong shaking and damage are confined to a localized area, as illustrated by the 2014 South Napa earthquake. In comparison, the 1989 magnitude 6.9 Loma Prieta earthquake caused damage over a region nearly 100 miles long. Local soil and geologic conditions, bedrock type, quality of building construction, and susceptibility to flooding (caused by dam or levee failure) can also affect the amount of damage at a particular site. This was dramatically demonstrated by the 1989 Loma Prieta earthquake, which devastated vulnerable parts of Oakland and San Francisco, more than 50 miles from the fault rupture.

How Can You Protect Yourself and Your Family?

Taking simple steps before and during earthquakes can help protect you and your family, as well as speed your recovery from an earthquake.

Before the next earthquake:

- Assess your home and work space, identify hazards, and secure moveable items.
- Create an emergency plan and organize disaster supplies to sustain you and your family for 72 hours or longer.
- Practice "Drop, Cover, and Hold On" to protect yourself when the ground begins to shake. Learn and practice what to do at home, work, or in school.
- Stay prepared by repeating these steps on a regular basis. For example, reassess your preparedness every year and participate in the annual Great California ShakeOut drill on the third Thursday in October.

Lack of adequate shear walls on the garage level exacerbated damage to this building at the corner of Beach and Divisadero in the Marina District, San Francisco, during the October 1989 Loma Prieta earthquake.

Brad T. Aagaard, James Luke Blair, John Boatwright, Susan H. Garcia Ruth A. Harris, Andrew J. Michael, David P. Schwartz, and Jeanne S. DiLeo

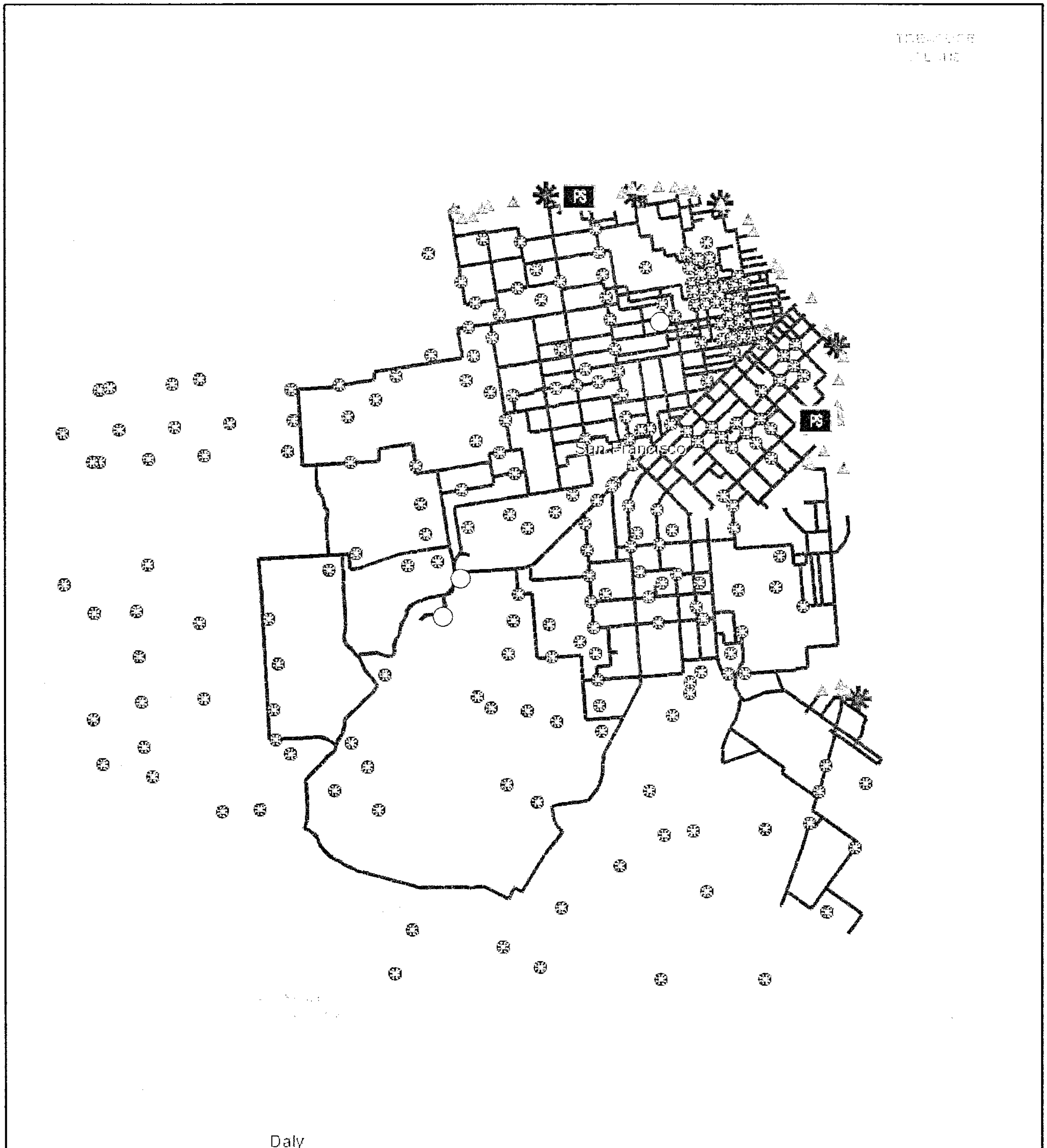
Edited by *Kate Jacques* and *Carolyn Donlin*

For more information contact:
1-888-ASK-USGS
(1-888-275-8747)

http://earthquake.usgs.gov/
http://ask.usgs.gov
https://www.facebook.com/USGeologicalSurvey
https://twitter.com/USGS

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20163020

Appendix H



Existing EFWS - Assets

San Francisco
Water

Services of the San Francisco Public Utilities Commission

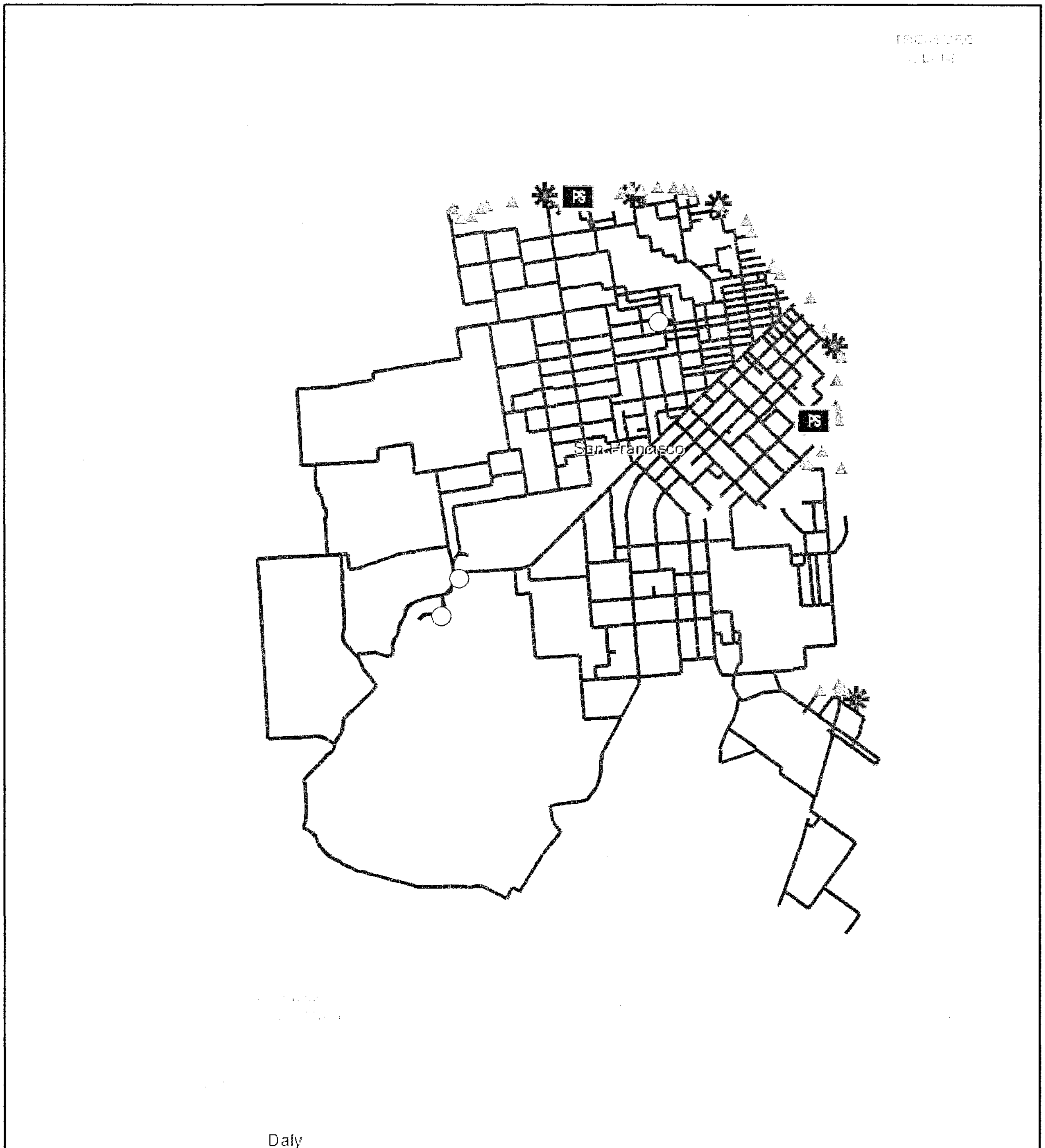
N

Miles
0 0.5 1 2 3

Legend

- AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- Cisterns
- AWSS Pipes

Appendix I



Existing EFWS - Pipelines

San Francisco Water
Services of the San Francisco Public Utilities Commission

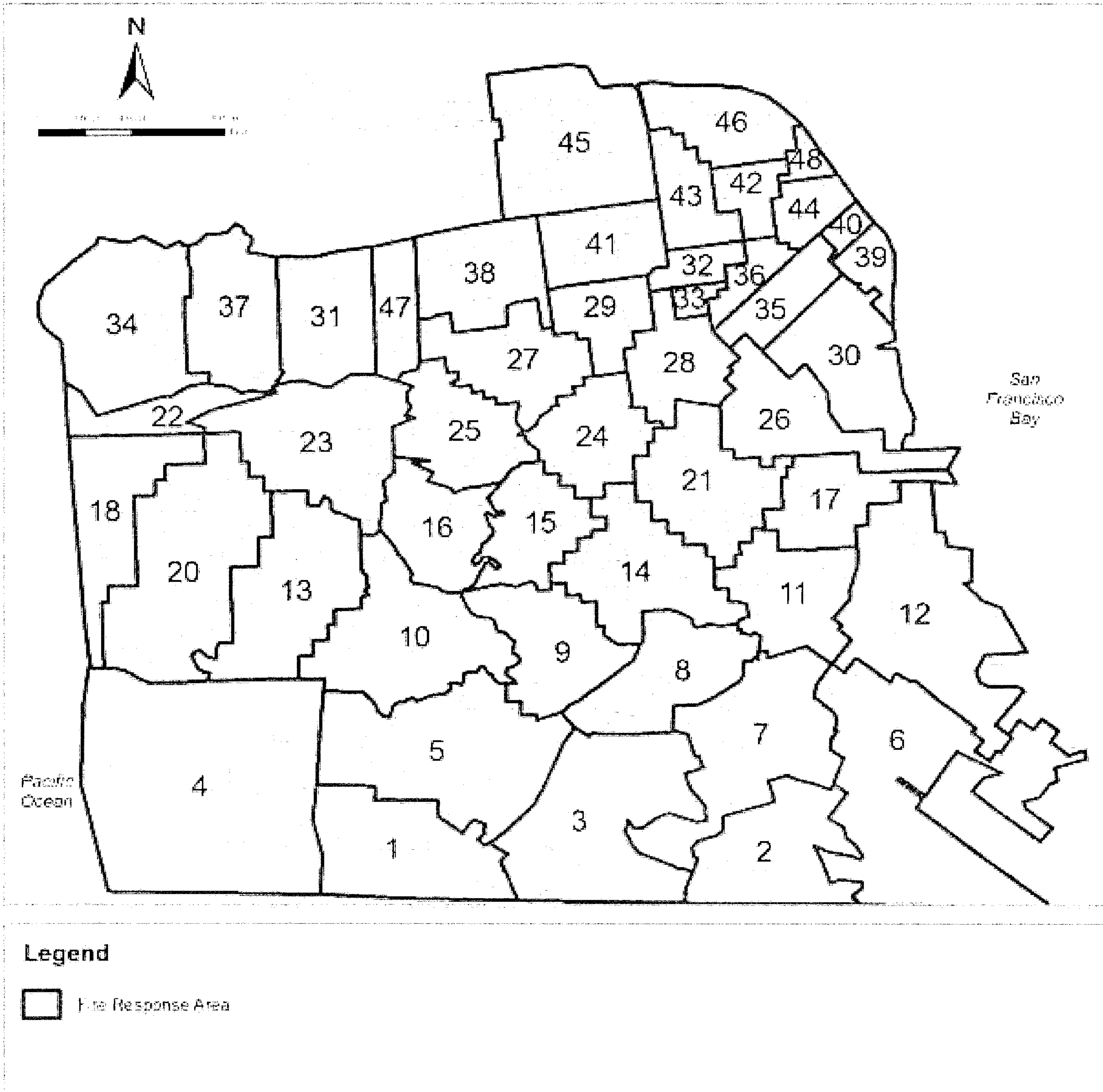
N

0 0.5 1 2 3 Miles

Legend

- AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- AWSS Pipes

Appendix J


N
45
46
48
43
42
44
40
39
41
32
36
38
33
35
34
37
31
47
29
27
28
30
San Francisco Bay
22
25
24
26
23
21
17
18
16
15
14
20
13
11
12
10
9
8
7
6
5
Pacific Ocean
4
3
1
2
Legend
Fire Response Area

Appendix K

Abstract

San Francisco is at significant risk due to fire following earthquake. This report analyzes fire following earthquake for San Francisco as part of a larger project undertaken by the San Francisco Department of Building Inspection entitled Community Action Plan for Seismic Safety (CAPSS). This specific report, on fire following earthquake, has been conducted with the support and assistance of the San Francisco Fire Department (SFFD).

A stochastic model for analyzing fire following earthquake for San Francisco has been developed, utilizing data received from CAPSS, SFFD and others, to assess fire following earthquake impacts due to four earthquake scenarios: magnitude 7.9, 7.2 and 6.5 events on the San Andreas fault near San Francisco, and a magnitude 6.9 event on the Hayward fault. These events cause high ground motions in San Francisco that result in ground failure in many parts of the City – ground motions are particularly high in the western part of San Francisco, which was not yet built up in 1906 and therefore is not protected by the special high pressure SFFD Auxiliary Water Supply System (AWSS). Depending on the specific earthquake scenario, these ground motions and ground failures are estimated to cause over 1,000 breaks in the potable water system, so that SFFD's AWSS and cisterns will be the only source of firefighting water in many parts of the City. The AWSS itself will sustain some damage, forcing SFFD to fall back to cisterns only in some places. At the same time, SFFD's 42 fire engines will almost certainly not be able to respond to all the post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for the magnitude 7.9 San Andreas event. As a result, the methodology employed here estimates ignitions, building burnt areas and dollar losses for the four scenario events. These results are presented in Table A-1 as ranges within which losses will fall half (i.e., 50%) of the time (correspondingly, half the time the losses will be outside – that is, either more or less) than the indicated ranges: .

Table A-1
Bounds for Losses to Buildings due to Fire Following Earthquake

	25% ~ 75% Confidence Range		
	Ignitions	Loss $ billions	**Total Burnt Building Floor Area** mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~ 28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

For example, for the Mw 7.9 event, essentially a repeat of the 1906 earthquake, losses will on average be about $7.6 billion, and half the time will be more than $4.1 billion and less than $10.3 billion. More detailed results are presented in the report, but the significance of these results is not in their precision, but rather in their overall magnitude. The model producing these results was validated by application to the 1989 Loma Prieta event, and examined for methodological and parametric sensitivity, with satisfactory results.

A number of opportunities exist for reducing the fire following earthquake in San Francisco, including further improvements in reliability of post-earthquake water supply, further support for NERT, and greater training for this problem for SFFD officers and firefighters.

Appendix L

Fire Protection Bonds (A)

PROPOSITION A

FIRE PROTECTION SYSTEM IMPROVEMENT BONDS, 1986. To incur a bonded indebtedness of $46,200,000 for the improvement of the fire protection system within the City and County of San Francisco.

YES 273
NO 274

Analysis

by Ballot Simplification Committee

THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.

THE PROPOSAL: Proposition A would authorize the City to borrow $46,200,000 by issuing general obligation bonds. This money would pay for improvements in San Francisco's fire protection system. These improvements would include extending the high pressure system, construction of new cisterns in residential areas, installation of a high pressure pump station at Lake Merced, construction of an emergency operations center, and other projects. The interest and principal on general obligation bonds are paid out of tax revenues. Proposition A would require an increase in the property tax.

A YES VOTE MEANS: If you vote yes, you want San Francisco to issue general obligation bonds totalling $46,200,000 to make certain improvements in the City's fire protection system.

A NO VOTE MEANS: If you vote no, you do not want San Francisco to issue bonds for these improvements in the City's fire protection system.

Controller's Statement on "A"

City Controller John C. Farrell has issued the following statement on the fiscal impact of Proposition A:

"Should the proposed Resolution be authorized and when all bonds shall have been issued on a twenty (20) year basis and after consideration of the interest rates related to current municipal bond sales, in my opinion, it is estimated that approximate costs would be:

Bond Redemption	$46,200,000
Bond Interest	38,808,000
Debt Service Requirement	$85,008,000

"Based on a single bond sale and level redemption schedules, the average annual debt requirement for twenty-two (22) years would be $3,864,000 which amount is equivalent to approximately one and twenty hundreths cents ($0.0120) in the current tax rate."

How "A" Got on the Ballot

On July 28 and August 4 the Board of Supervisors voted 8-0 in favor of the ordinance placing Proposition A on the ballot.

The ordinance was signed by Mayor Dianne Feinstein on August 6.

THE FULL LEGAL TEXT OF PROPOSITION A APPEARS ON PAGE 96

NOTE: YOUR POLLING PLACE MAY HAVE CHANGED. PLEASE REFER TO MAILING LABEL ON BACK COVER.

NO ARGUMENT WAS SUBMITTED AGAINST PROPOSITION A

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

In 1906, as dawn was about to break on April 18, a giant earthquake hit the City, touching off 52 separate fires. Those downtown swiftly joined in a huge conflagration that swept westward from the waterfront, leaving much of the City in ruins.

If another major quake strikes—(and seismic experts say it will, but they can't pinpoint when), the City must be prepared.

Our firefighters must have sufficient water to fight spreading fires and quickly to control them. That's the only way our City will survive.

In 1906, water mains broke and left the City defenseless.

Proposition A will assure adequate water in every neighborhood throughout the City.

Proposition A will provide $46 million in general obligation bonds to expand and improve emergency water supplies throughout the City. Residential areas will be provided with underground cisterns, and the high-pressure water supply system will be extended. Suction hose connections to City lakes, San Francisco Bay and the Pacific Ocean will provide additional millions of gallons of water.

These emergency fire-fighting water supplies are necessary to protect our homes, schools, hospitals, churches and other structures from the threat of fire that inevitably comes with a monstrous quake.

This increased fire protection will benefit the entire City and all who live, work and vist here.

Vote Yes on Proposition A.

Dianne Feinstein, Mayor

ARGUMENT IN FAVOR OF PROPOSITION A

As a result of the earthquake and fire in 1906, San Francisco suffered great destruction and devastation from the conflagration which followed, including the destruction of 28,000 buildings.

Due to broken water mains caused by the earthquake, the San Francisco Fire Department was unable to stop the fire from getting out of control.

Proposition A will provide for the expansion of a high pressure fire-fighting water system to the residential districts of the City, which will be critical in emergency situations.

Underground cisterns also will be constructed in the outer residential districts to provide emergency water supply in areas not served by the high pressure system.

High pressure system gate valves will be motorized with emergency battery powerpacks so they can be opened and closed in an emergency when normal power is disrupted.

Suction connections will be provided to San Francisco Bay, the Pacific Ocean, and City lakes so that fire department pumpers can quickly connect and pump water from these large bodies of water to any fires.

A pumping station for the high pressure system will be constructed at Lake Merced to provide an important source of water from the western part of the City.

An Emergency Operations Center will be built to provide a command center for operations in earthquakes and other major disasters.

The recent fire and explosion in the Hunter's Point district demonstrated the critical need for water supplies in a major fire. The broken water main caused by the explosion severely hampered the Fire Department in controlling this major fire. This is an example of what can happen when normal water supplies are disrupted.

Increased earthquake activity in California demonstrates the importance of this Proposition.

The fire department can function only if an adequate water supply exists. Proposition A will provide an emergency fire-fighting water supply for the City, and ensure that fires will not get out of control due to lack of water, following an earthquake.

We urge all citizens to vote yes on Proposition A. This is protection for your home and your City.

—Submitted by the Board of Supervisors

ARGUMENT IN FAVOR OF PROPOSITION A

The Fire Commission and Chief of Department urge a YES vote on Propositon A—a $46.2 million Earthquake Preparedness Program.

This construction Program is designed to provide an updated and expanded emergency water supply system so that all areas of the City and County of San Francisco will be protected in case of a conflagration following an earthquake or other disaster.

The major components of the Program are: high-pressure water supply extensions, underground cisterns, pumping station, emergency operations center, suction hose connections to the Bay and lakes, and a study to determine fire station reconstruction needs and their earthquake safety.

Help the San Francisco Fire Department provide increased fire protection. **VOTE YES ON PROPOSITION A.**

Henry E. Berman, President, Fire Commission
Curtis McClain, Vice President, Fire Commission
Juanita Del Carlo, Commissioner, Fire Commission
Richard J. Guggenhime, Commissioner, Fire Commission
Anne S. Howden, Commissioner, Fire Commission
Emmet D. Condon, Chief of Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans will not forget, nor should they, the tragic Bayview/Hunter's Point fire on April 4, 1986. Coincidentally, two earthquakes rocked the Bay Area in the weeks following the Bayview fire.

Following the Bayview fire, I requested Board of Supervisors hearings to investigate the adequacy of San Francisco's emergency water supply in the Bayview, Ingleside, Balboa Terrace, Oceanview, Lakeside, Forest Hill, Crocker-Amazon, St. Francis Wood, West Portal, Diamond Heights, Visitacion Valley, Merced Manor, Excelsior, Portola, Silver Terrace, Miraloma Park, Forest Knolls, Inner Sunset, Lakeshore Acres, Monterey Heights, and Outer Mission neighborhoods, and to implement a program to correct deficiencies in our emergency firefighting capabilities. From these hearings and deliberations of the Fire Commission, Proposition A emerged.

VOTE YES ON A.

Proposition A is a $46,200,000 general obligation bond issue to construct a comprehensive emergency water supply system and an emergency operations center for firefighting in the event of a disaster.

That may seem like a lot of money, but it represents, in this case, a prudent, far-sighted investment in San Francisco's future. Unfortunately, we can't guarantee another Bayview-type fire won't happen. But we can be better prepared if one **does** happen, and significantly reduce the risk to life and property in the Bayview, Hunter's Point, the Outer Mission, and all of the West of Twin Peaks area.

Please vote "Yes" on A.

Quentin L. Kopp, Supervisor

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquakes are a major concern to all of us who live in California, and a potential cause of disaster for San Francisco. Following a major earthquake it is highly likely that multiple fires will occur. San Francisco with its highly congested blocks of wooden buildings would face a conflagration (fire storm), if a major earthquake caused water supplies to be disrupted.

Proposition A, as an Earthquake Preparedness measure, is very important for San Francisco. It will provide for Emergency Water Supply necessary for fire fighting.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Bruce Bolt, Professor of Seismology
Karl V. Steinbrugge, Past Chairman
California Seismic Safety Commission
Charles Scawthorn, Structural Engineer
Joe J. Litehiser, Seismologist
Donald H. Cheu, M.D., Vice Chairman
Governor's Earthquake Task Force

ARGUMENT IN FAVOR OF PROPOSITION A

We support this important Earthquake Preparedness Program.
VOTE YES ON PROPOSITION A.

Willie L. Brown, Jr., Speaker of Assembly
Michael Hennessey, Sheriff
Morris Bernstein, President, Airports Commission
Douglas Engmann, Commissioner, Board of Permit Appeals
E. L. Friend, President
Anne Halstead, Commissioner, Port Commission
Thomas E. Horn, President, War Memorial Board of Trustees
Melvin D. Lee, Commissioner, Redevelopment Commission
Robert J. McCarthy, Vice President, Board of Permit Appeals
Al Nelder, Commissioner, Police Commission
Michael Salarno, Member, S.F. Parking Commission
William K. Coblentz, Attorney
Gordon J. Lau, Attorney
Steven L. Swig, Attorney

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection for San Francisco's neighborhoods is a vital factor. Emergency Water Supplies for fire fighting are necessary so that the Fire Department can provide ample protection to our homes in the event an earthquake damages water mains as occurred in 1906.

Proposition A will expand and improve the Fire Department's Emergency Water Supplies.

- Suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- Underground cisterns will be provided in residential areas.
- The High-Pressure System will be extended to outer residential districts.

The cost of Proposition A is .0120 cent per $100 valuation on the property tax; this means a home valued at $150,000 would pay $17.16 per year for this protection. This is highly cost effective insurance for our homes.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Marguerite A. Warren
James J. Walsh, Jr.
Dorothy Agnes McDougall
Andrew Jones
George L. Newkirk
Jess T. Esteva
Dolph Andrews
Norman V. Wechsler

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection and Earthquake Preparedness concern all school officials in San Francisco.

Proposition A is an important program that will provide **Emergency Water Supplies For Fire Fighting** throughout the City.

When a major earthquake strikes, the Fire Department must have a dependable water supply to protect our families, homes and schools.

Earthquakes cannot be stopped, but we must have water to stop the fires that will occur.

We ask all citizens to join us and **VOTE YES ON PROPOSITION A.**

Myra A. Kopf, President, Board of Education
A. Richard Cerbatos, Vice President, Board of Education
Libby Denebeim, Member, Board of Education
JoAnne Miller, Member, Board of Education
Benjamin Tom, Member, Board of Education
Sodonia M. Wilson, Member, Board of Education
Rosario Anaya, Member, Board of Education
Ernest C. Ayala, President, S.F. Community College Board
Al Vidal, Principal, Washington High School

ARGUMENT IN FAVOR OF PROPOSITION A

Improved and expanded Emergency Water Supplies for fire fighting in San Francisco are a necessary factor to prevent another conflagration (fire storm) from sweeping the City as occurred in 1906.

Our central business and financial districts are the economic heart of the City, the residential districts contain the homes of our citizens.

Proposition A provides increased fire protection to our high-rise buildings and our homes.

Earthquake preparedness and protection from the ravages of fire concern us all. As civic leaders of San Francisco we urge all citizens to **VOTE YES ON PROPOSITON A.**

Lee Dolson, General Manager, Downtown Association
James R. Bronkema, President, Embarcadero Center

ARGUMENT IN FAVOR OF PROPOSITION A

We can bet that most of you have seen the circles of bricks encompassing certain intersections in some neighborhoods in San Francisco. These circles mark underground water cisterns that were constructed "after" the devastating earthquake and fire in 1906. Many neighborhoods in San Francisco built after 1912 are NOT serviced by this alternate water system.

Proposition A would provide a City-wide emergency water supply system to protect our homes and neighborhoods.

We cannot prevent earthquakes but we can take precaution against fire. . .the biggest threat to San Francisco.

We urge a YES vote on Proposition A. . .fire protection for our families no matter where they may be in our City.

Nancy Honig
Roxanne Mankin
Jane McKaskle Murphy
Bernice E. Ayala
Cheryl Arenson
Gina Moscone
Jonnie B. Johnson

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and increased fire protection are of vital concern to all citizens of San Francisco.

VOTE YES ON PROPOSITION A.

Robert Bacci
Michael Bernick
Susan Bierman
Frank T. Blackburn
Rev. Dr. Amos C. Brown
Sally Brunn
Stafford Buckley
Michael Chan
Charles D. Cresci
Rosemary DeGregorio
Todd Dickinson
H. Welton Flynn
Ron Huberman
Ralph Hurtado
David Jenkins
Agar Jalcks
Carole Migden
Polly V. Marshall
Alicia Wang
Thomas F. McDonough
Tony Kilroy
Leroy King
David Looman
Christopher Martin
Peter Mezey
Marilyn Miller
Jeff Mori
Sandy Mori
Yoshio Nakashima
Mitchell Omerberg
Edward J. Phipps
Linda Post
Thelma Shelley
Robert J. Tully
Yori Wada
Evelyn Wilson
Pansy Panzio Waller
Bruce W. Lilienthal
Jim Wachob

ARGUMENT IN FAVOR OF PROPOSITION A

Pure self interest dictates that we provide an abundant and surplus supply of "fire protection" water for EVERY part of San Francisco, not just half of it! VOTE YES!

W. F. O'Keeffe, Sr., San Francisco Taxpayers Association

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

Emergency water supplies for fire fighting are vital for San Francisco. On April 4, 1986, an explosion and fire occurred in the Bayview District, causing nine deaths. The disrupted water supply caused by the explosion, severely hampered the Fire Department in controlling this fire.

In the event of a major earthquake it is highly likely that water mains will be damaged throughout San Francisco. Proposition A will provide for 94 underground cisterns to be built in residential areas where few emergency water supplies now exist. The Bayview fire demonstrated the need for emergency water supplies for fire fighting.

Protect your neighborhood and home.

VOTE YES ON PROPOSITION A.

Concerned Citizens for Improved Fire Protection

Michael Frew, Chairman
John Holt
Robert L. Kreuzberger
Ed F. Patterson
Michael S. Newman
Mel S. Newman
Jack R. Brower
August J. Nevolo

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans remember what happened in 1906. The fires that occurred after the earthquake swept the City and left many thousands of people homeless.

Proposition A is a common sense program to provide **Emergency Water Supplies for Fire Fighting** throughout the City. This would ensure that fires would not get out of control due to lack of water supply.

This $46.2 million bond issue needs a two-thirds vote. As a former member of the Board of Supervisors and neighborhood businessman, I urge all citizens to vote for this important program. It is protection for your family, home and city at a very low cost; it makes sense in both human and economic terms.

VOTE YES ON PROPOSITION A.

John Barbagelata, Realtor

ARGUMENT IN FAVOR OF PROPOSITION A

Proposition A assures San Francisco residents of on-going preparation which is the best defense against a major disaster—earthquake, conflagration, or an explosion.

San Francisco Fire Fighters regard this measure as the first-step in the earthquake preparedness program.

Control disaster with expanded fire protection!

San Francisco Fire Fighters urges a **YES** vote on Proposition A.

James T. Ferguson, President,
San Francisco Fire Fighters Local 798

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection is a serious concern for all citizens of San Francisco. We, the working Fire Chiefs of San Francisco are well aware of what happened in 1906, when fires occurring after the great earthquake burned thousands of buildings and left over 200,000 homeless.

The quake caused hundreds of breaks in water mains and the lack of water supplies prevented the Fire Department from controlling the fire.

We do not want this to happen again.

Proposition A will provide **Emergency Water Supplies for Fire Fighting.** The following installations will be placed in our neighborhoods to protect our homes.

- 94 underground cisterns will be built.
- 56 suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- The High-Pressure System will be extended to residential areas.
- Improvements to tanks, reservoirs, pump stations, including a new pump station at Lake Merced and an Emergency Operations Center.

The recent fire in the Bayview District that took nine lives demonstrated how important water supplies can be. The damaged water supply caused by the fire and explosion seriously hampered Fire Department efforts to control this major fire.

We as the working Fire Chiefs who actually run the day-to-day field operations in San Francisco urge all citizens to support this important measure.

VOTE YES ON PROPOSITION A.

John W. Flaherty
President, The San Francisco Fire Chiefs Association
Gary J. Torres
Secretary, The San Francisco Fire Chiefs Association

ARGUMENT IN FAVOR OF PROPOSITION A

Fire safety can be improved by voting FOR Proposition A and AGAINST BART director Eugene Garfinkle. BART's a fire trap.

Tom Spinosa, BART Board candidate

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and Fire Protection are vital factors for all citizens.

VOTE YES ON PROPOSITION A.

A. Cecil Williams, Glide United Methodist Church
Bob Barry, President, S.F. Police Officers Association
William Corvin, President, California Steam Company
J. M. Eaneman, President, AMC Cancer Research Board of Directors
George Foos, Chairman, Great Western Value Centers
Rev. John L. Green, Chaplain, S.F. Fire Department
Albert S. Samuels, Jr., Past President, Market Street Project
Harvey Matthews, Bayview-Hunter's Point Democratic Club
Arthur Goedewaagen, President, Sunset-Parkside Education & Action Committee

ARGUMENT IN FAVOR OF PROPOSITION A

Prior to the Great Earthquake and Fire of 1906, San Francisco Fire Chiefs had always insisted the City was not prepared for a major disaster. History proved them correct. Today, 80 years later, San Francisco's preparation is still not adequate.

When each of us was Chief of Department, we emphasized the need for the additional preparedness necessary to prevent a sweeping fire storm or catastrophic disaster. That state of preparedness has yet to be attained. However, Proposition A offers a once-in-a-life opportunity to protect life and property, through preparation, at an extremely minimal cost. This opportunity should not be missed.

Proposition A will provide the necessary water supplies vital to preventing another conflagration of the 1906 magnitude!

Proposition A will expand the high-pressure firefighting water supply system beyond the commercial areas into the residential neighborhoods!

Proposition A will greatly improve fire defenses not only in the western part of San Francisco but City-wide as well!

Proposition A will ensure that San Francisco is no longer one of the few remaining major cities with a sub-standard Emergency Operations Center for command and control during disasters and earthquakes!

As former San Francisco Fire Chiefs, we urge you to **VOTE "YES" ON PROPOSITION A.**

William F. Murray, Chief, San Francisco Fire Department, Retired
Keith P. Calden, Chief, San Francisco Fire Department, Retired
Andrew C. Casper, Chief, San Francisco Fire Department, Retired

ARGUMENT IN FAVOR OF PROPOSITION A

- Yes on Proposition A.
- Local fire chiefs have warned about grave BART fire catastrophe dangers. End disregard of public safety.

—San Franciscans for BART Safety

ARGUMENT IN FAVOR OF PROPOSITION A

This is a vital issue for San Francisco. **Emergency Water Supplies for Fire Fighting** must be provided throughout the City.

Many fires will occur if a major earthquake strikes San Francisco.

The Fire Department needs a water suply to prevent a conflagration (fire storm) from occurring again, as it did in 1906.

Earthquakes are a geologic fact of life and cannot be prevented, but we can prepare for the fires that will occur, this makes sense for all citizens.

VOTE YES ON PROPOSITION A.

Philip S. Day, Jr.
Director, San Francisco Office of Emergency Services
Richard Eisner, Earthquake Preparedness Consultant
Jelena Pantelic, Chairperson, Disaster Preparedness Committee
Joe Posillico, Emergency Services, Salvation Army
Peter Ashen, Disaster Director, American Red Cross

ARGUMENT IN FAVOR OF PROPOSITION A

San Francisco Council of Civic Organizations endorsements:
Proposition A—YES
Proposition M—YES

Terence Faulkner
President, San Francisco Council of Civic Organizations

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and providing Emergency Water Supplies for Fire Fighting are of vital importance to San Francisco.

VOTE YES ON PROPOSITION A.

Donald J. Birrer, Director of Public Works
Frank M. Jordan, Chief of Police
Dean Macris, Director of Planning
Rudy Nothenberg, General Manager, Public Utilities
William Stead, General Manager, Municipal Railway
David Werdegar, M.D.M.P.H., Director of Public Health
James D. Cooney, General Manager, S.F. Water Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Appendix M

FIRE COMMISSION

City and County of San Francisco

Gavin Newsom, Mayor

Victor Makras, *President*
Stephen A. Nakajo, *Vice President*
George Lau, *Commissioner*
Andrea Evans, *Commissioner*

698 Second Street
San Francisco, CA 94107
Telephone 415.558.3451
Fax 415.558.3413
Monica Quattrin, *Commission Secretary*

SAN FRANCISCO FIRE COMMISSION

RESOLUTION 2010-01

ENCOURAGING THE FIRE DEPARTMENT TO PURSUE GRANT FUNDING IN THE AMOUNT OF $9.785 MILLION FROM THE FEDERAL GOVERNMENT, TO EXPAND THE DEPARTMENT'S PORTABLE WATER SUPPLY SYSTEM.

WHEREAS, The uniformed employees of the San Francisco Fire Department (SFFD) respond to approximately 100,000 incidents a year; and,

WHEREAS, It is the responsibility of the SFFD and its members to protect the lives and property of the citizens of San Francisco from the effects of natural disasters; and,

WHEREAS, The United States Geological Survey has issued increasingly frequent warnings of the high probability of a potentially catastrophic earthquake in the San Francisco Bay Area during the next thirty years; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the spread of fire following earthquakes in modern urban settings, have predicted that there is a high likelihood that San Francisco will be subject to multiple simultaneous conflagrations following a major Bay Area earthquake; and,

WHEREAS, The assessed value of the real estate in San Francisco subject to property taxation exceeds $100 billion; and,

WHEREAS, The spread of fire following earthquakes in a modern urban setting typically is responsible for as much as 75% of the total dollar loss that results; and,

WHEREAS, Loss of life following an earthquake in a modern urban setting is greatly exacerbated by the effects of resultant fires in buildings where occupants have been trapped by structural collapse; and,

WHEREAS, The Auxiliary Water Supply System does not cover the entire geographic areas of the City and County of San Francisco; and,

WHEREAS, The SFFD's Portable Water Supply System has been proven effective in the above-ground transmission of water for fire fighting purposes; and,

WHEREAS, The Portable Water Supply System works in conjunction with and can supplement the existing Auxiliary Water Supply System, and therefore the Portable Water Supply System is capable of partially mitigating the possible lack of domestic water system availability following a major earthquake; and,

WHEREAS, the number of units currently comprising the SFFD's existing Portable Water Supply System is not adequate to supply all areas of San Francisco where the Auxiliary Water Supply System does not extend; and

WHEREAS, the proposed design for expanding the Portable Water Supply System has been shown to be a highly cost effective and functionally adaptable method of providing the means by which firefighters can attack multiple conflagrations simultaneously;

WHEREAS, the SFFD is working with Senator Dianne Feinstein and Speaker of the House Nancy Pelosi in seeking these grant funds, now therefore, be it

RESOLVED, That the Fire Commission encourages the Fire Department to actively pursue grant funds in the amount of $9.785 million from the Federal government, to expand the Portable Water Supply System and train SFFD uniformed members, the Fire Reserve, and other members of the community who may assist the SFFD in times of disaster.

Adopted at the Regular Meeting of the San Francisco Fire Commission on January 14, 2010.

Ayes: 4 (Makras, Nakajo, Lau, Evans)
Nays: 0

Monica Quattrin

Monica Quattrin, Commission Secretary

Appendix N

Frequently Asked Questions - Fire Suppression Water Systems

San Francisco Water
Services of the San Francisco Public Utilities Commission

1) What is the Auxiliary Water Supply System, and what is its primary function?

The Auxiliary Water Supply System (AWSS) is a non-potable fire-suppression water system that was built the decade following the catastrophic 1906 San Francisco earthquake. The purpose of the AWSS is to provide the San Francisco Fire Department (SFFD) with a high-pressure fire suppression water system that can be utilized during large fires. The system is vital for protection against the loss of life, homes, and businesses from fire following an earthquake and non-earthquake multiple-alarm fires.

There are two aspects of the AWSS that are critical to its success:

1. Distribution infrastructure: The AWSS consists of over 135 miles of high-pressure pipeline and hydrants. The system utilizes approximately 30 seismically-reliable motorized valves, allowing the SFPUC to valve off sections of the system, to ensure that pressure is maintained in areas where fires are occurring.
2. The water supply that feeds into the AWSS distribution infrastructure. The primary source of the AWSS is the SFPUC's Hetch Hetchy Water System.

The original AWSS system consisted of three reservoirs and two seawater pumping stations. Their capacities:

- 10.5 million gallon Twin Peaks Reservoir,
- 0.5 million gallon Ashbury Heights Tank, and
- 0.75 million gallon Jones Street Tank.
- Seawater pump station #1: 10,000 GPM (located in SOMA)
- Seawater pump station #2: 10,000 GPM (located near Aquatic Park)

In 2010, the management of the AWSS was transferred to the San Francisco Public Utilities Commission (SFPUC). A shared goal of the SFPUC and SFFD is doing the following to expand and improve the reliability of the water supply serving the AWSS. The agencies have undertaken the following to do so:

- 95% completion of the $4.8 billion Water System Improvement Program (WSIP), providing robust seismic upgrades to the pipelines, reservoirs, and infrastructure that supply water to San Francisco and the greater Bay Area;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;

- Analyzing the usage of the 90 million gallon North Basin of Sunset Reservoir as a water Supply for a Potable AWSS in the Sunset and Richmond Districts; and
- Investigating the installation of a seawater pump station at Ocean Beach to serve as a secondary source of water for fire suppression for the Sunset and Richmond Districts.

In addition to the AWSS, the SFPUC's low-pressure drinking water system and its low-pressure hydrants, as well as approximately 180 cisterns throughout San Francisco, can be pumped and utilized by SFFD Fire Trucks for fire-suppression.

2) Is the AWSS located throughout San Francisco? If not, why?

The AWSS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the central business district and the majority of the city's population at that time.

The San Francisco Public Utilities Commission (SFPUC), SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the SFPUC intends to use the best possible technology available to meet the performance standards of the SFFD. Please standby for future updates to the SFPUC webpage for images, graphics, and maps showcasing the original AWSS system, recent upgrades, and future projects.

3) Who manages the AWSS, the SFPUC or the SFFD? How does the SFFD know that the AWSS system is being adequately and reliably maintained?

The SFFD owned and managed the AWSS and the fire hydrants on the potable water system from the early 1900s until 2010. During this time the SFFD collaborated with staff from San Francisco Public Works (SFPW) to implement upgrades to the system. In 2010, the AWSS was transferred to the SFPUC, the City's experts in water supply piping systems. By bringing in the SFPUC to work with SFFD and SFPW, City leaders created an interagency team with all of the expertise needed to manage, operate, and update the AWSS.

The SFFD is considered the end user of the system, and therefore system improvements and expansion completed by SFPUC must meet the rigorous and high-quality standards of the SFFD. The SFFD and SFPUC meet monthly to discuss operations of the AWSS, report on maintenance activities, review capital and developmental project design and status, and communicate on policies and procedures that affect both departments.

This partnership presents the best of both worlds for San Franciscans. The women and men of SFFD are internationally-recognized for their expertise, experience, and bravery in fighting fires. Similarly, the SFPUC, with its Hetch Hetchy Water System, is recognized as one of the top water agencies in the world. The SFPUC has hundreds of engineers that are experts in designing, expanding, and improving water systems. Additionally, the SFPUC has over 80 plumbers and dozens of construction management experts in-house that are dedicated to providing high-quality maintenance and oversight of the construction projects needed to keep the AWSS functioning for the SFFD's use.

With the two agencies working together, in partnership with SFPW, the City of San Francisco has the experts it needs to successfully operate, expand, and improve the AWSS.

4) What are the SFPUC and SFFD doing to increase fire protection in the areas of the City that do not have the AWSS?

When the SFPUC took over control of the system, the agency worked with SFFD to complete a review of all existing facilities and a comprehensive Planning Study.

The analysis modeled the hydraulic reliability of the existing AWSS after a major earthquake. In this context of this study, hydraulic reliability is defined as the percentage of the water needed by SFFD to fight fires that would be met by the AWSS and other sources after a 7.8 earthquake on the San Andreas Fault.

Our analysis showed that the 2010 AWSS was 47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake. Utilizing this information, the SFPUC, SFFD, and SFPW identified projects that would increase system reliability and could be funded by the 2010 and 2014 Earthquake Safety and Emergency Response (ESER) Bonds authorized by San Francisco voters. Decisions on which projects to implement utilizing bond funds are based on a given project's ability to improve the reliability score for the Fire Response Area that the given project serves and to increase the likelihood of delivering water after an earthquake.

Bond-funded projects make seismic upgrades to the system and repair, replace, and extend system components to increase the ability to provide adequate water for firefighting. Funding is allocated to repair, replace, and extend system components to improve the ability to provide adequate water for firefighting purposes following a major earthquake and during multiple-alarm fires from other causes. This includes repairs and upgrades to core facilities, pipelines, and tunnels, and construction of new cisterns.

The following projects have been completed utilizing the funds from the 2010 and 2014 bonds:

- Installation of 30 new cisterns (with 15 of these cisterns installed in the Sunset and Richmond districts);
- Reliability upgrades at the three primary source supplies – Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- 6 pipeline and tunnel projects.

The following projects are in construction and/or design phase:

- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- 16 pipeline and tunnel projects;
- Motorizing critical seismically-reliable valves for remote control, and improving the electronic control system of the valves; and
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;
- Preliminary analysis for a Potable AWSS for the Sunset and Richmond Districts. *Additional information on that system can be found in questions 6-11.*

Once fully completed, the projects implemented with the ESER 2010 bond funds will increase the citywide reliability score from 47% to 67%. The full completion of the projects implemented with the ESER 2014 bond funds will increase the citywide reliability score from 67% to 87%. Construction of additional recommended future projects will increase the citywide reliability score to 96%.

5) Who makes decisions on the selection and implementation of AWSS projects? Who reviews the progress and implementation of AWSS capital projects?

Overseeing the selection and implementation of AWSS projects is the Management Oversight Committee consisting of SFPUC General Manager Harlan Kelly, SFFD Chief Joanne Hayes-White, SFPW Director Mohammed Nuru, and SFPUC Assistant General Manager of Water Steve Ritchie.

The San Francisco Capital Planning Committee, consisting of the City Administrator and including the President of the Board of Supervisors, the Mayor's Budget Director, the Controller, the City Planning Director, the Director of Public Works, the Airport Director, the Executive Director of the Municipal Transportation Agency, the General Manager of the Public Utilities System, the General Manager of the Recreation and Parks Department, and the Executive Director of the Port of San Francisco, reviews the progress and implementation of AWSS capital projects. Capital Planning Committee meetings are open to the public. Please find more info at the Committee's webpage.

6) Are the SFPUC and SFFD looking at something called a Potable AWSS for fire suppression on the Westside of San Francisco. What is a Potable AWSS? How does it function? How is it different from the existing AWSS?

The word "potable" is defined as "safe to drink". The Potable AWSS currently under analysis will connect to the 90 million gallon North Basin of the Sunset Reservoir, and will provide a high-pressure firefighting system for the SFFD to fight fires in the Richmond and Sunset Districts. **The Potable AWSS will meet the same rigorous standards required by SFFD to fight large fires, and will utilize the same earthquake resistant pipes, seismically-reliable valves, hydrants, and components utilized by the AWSS, and therefore will be designed to function at the high-pressure level required by SFFD.** The Potable AWSS project is currently in the planning and analysis phase. The SFPUC will work with SFFD to design the system with operational capabilities and design criteria standards equal to or exceeding the existing AWSS.

The Potable AWSS will also have roughly 5 connections to potable water pipes in the Sunset and Richmond districts. **These connections will utilize the same valves as the 30 valves the existing AWSS currently uses to isolate sections of the AWSS to maintain system pressure.** Additionally, these 5 valves will be tested at the same schedule as the existing valves to ensure their performance during an incident. During non-fire events, the Potable AWSS pipeline will be one of many pipes supplying drinking water to the Richmond and Sunset districts.

In the event of a major fire, the approximately five isolation valves will be closed automatically, remotely, or manually, which are the same methods that the 30 valves on the existing AWSS utilize. These five isolation valves will be closed so that the Potable AWSS will be disconnected from the City's low-pressure water system and therefore can provide reliable high-pressure water for fire-fighting. If the Potable AWSS is isolated for firefighting use, homes and businesses will continue to be served by other redundant low-pressure drinking water distribution pipes, assuming that those low-pressure pipes have not incurred numerous breaks and leaks during the earthquake.

An additional benefit of the Potable AWSS is that it will be designed and constructed to meet required AWSS performance standards, and the system will be rated to meet drinking water standards. This means that after firefighting following an earthquake, the Potable AWSS will be able to provide drinking water to the Sunset and Richmond Districts even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

7) Does the Potable AWSS provide an equivalent amount of fire protection when compared to the existing AWSS? Does the Potable AWSS provide the water pressure and supply of water needed by SFFD to fight small and large fires?

Yes. The Potable AWSS will be designed to meet all SFFD performance requirements. The SFFD will not reduce or lower their robust performance standards, and therefore the SFPUC must design, construct, maintain, and operate the Potable AWSS system to meet these standards. The SFPUC is currently working in conjunction with SFFD to design a system that will have pressure and performance capabilities equal to or exceeding AWSS.

8) Does the Potable AWSS use the same type of earthquake resistant piping and valves as the AWSS?

Yes. The Potable AWSS will use earthquake resistant piping that is equal or better than the current AWSS piping design standard. Additionally, the Potable AWSS will utilize the same seismically-reliable valves as the 30 existing valves currently utilized by the AWSS to isolate sections of the system to ensure supply reliability in areas with fires. The hydrants utilized will also be the same as the existing AWSS. All of these components will be able to property function at the high-pressure levels required by SFFD.

9) The Potable AWSS relies on automatic valves to boost the water pressure to the level needed to fight big fires. What if the automatic valves fail, will SFFD be without the water they need to fight big fires? Does the existing AWSS rely on these automatic valves to fight fires? Does the Potable AWSS rely on more of these valves than the existing AWSS?

The potable AWSS will be isolated after an earthquake from the remainder of the distribution system by seismically-reliable motorized valves using the same method and equipment as current AWSS valves. All valves, future and existing, have redundant safeguards and a maintenance program that will ensure their performance. The valves can be operated manually if the valve actuators fail, just like the existing AWSS motorized valves. The valves are utilized by the existing AWSS and the future Potable AWSS to isolate sections of pipe to ensure that the systems provide the water supply and pressure needed by SFFD to fight big fires.

The quantity of the motorized valves on the future Potable AWSS will be dependent on the length of the Potable AWSS pipeline constructed, but is anticipated to be approximately 5 valves.

10) Are there other cities that have implemented a Potable AWSS? Or do other cities utilize systems similar to the existing AWSS?

Only one other city in the world, Vancouver, B.C. Canada, has been identified as having an isolated secondary firefighting system similar to the existing AWSS. Vancouver's system is less than 10 miles in length, while ours has over 135 miles.

To our knowledge, all other cities rely on their low-pressure potable water system and hydrants for fire-fighting. In Japan, a country that has similar seismic risk to that of San Francisco, cities utilize a system similar to the proposed Potable AWSS. The Japanese system is designed similar to our proposed Potable AWSS – for fighting a large fire after an earthquake, seismically-reliable water transmission mains and hydrants are isolated from the rest of the distribution system using seismically-reliable valves. This allows the Japanese's seismically reliable mains to be increased in pressure and used for fire-fighting. After the fires are suppressed, the Japanese system is used to provide drinking water to residents and businesses.

Recently a team of Japanese water engineers came to San Francisco to showcase the success of their piping system and their experience using Kubota pipes to SFPUC and SFFD staff. The Japanese team highlighted the success of their system and its piping in its utilization after earthquakes to fight fires.

Japan's successful implementation and use of a system similar to the proposed Potable AWSS showcases that the approach and technology do work in fighting fires after a major earthquake.

10) If the SFPUC is proposing to fill the Potable AWSS from Sunset Reservoir, how much water is in Sunset Reservoir?

The North and South Basins have a combined capacity of 176 million gallons. The North Basin, with a capacity of 90 million gallons, will be connected to the Potable AWSS. The North Basin recently underwent a $64 million seismic upgrade, and is designed to withstand a 7.9 San Andreas Fault earthquake. It can be isolated from the South Basin, and therefore all 90 million gallons could be used for firefighting purposes.

11) Can Sunset Reservoir provide enough water for SFFD and civilian use during a fire? How long will the water in Sunset Reservoir last if the reservoir is unable to be re-filled by the SFPUC's Hetch Hetchy Water System, the SFFD is utilizing the Potable AWSS to fight a fire, and civilians are utilizing the reservoir?

If firefighting requires a flow of 14,000 gallons per minute for the Sunset and Richmond districts, the 90 million gallon water supply in the North Basin of Sunset Reservoir will last for 4.5 days. This assumes that no additional water is added from the Hetch Hetchy Water System, which is **very** unlikely. Please see question #12 for additional info.

During an emergency situation, the South basin of Sunset Reservoir will be isolated from the North Basin, allowing the North Basin to be used solely for firefighting purposes. The 86 million gallon South Basin will still be connected to the City's low-pressure drinking water distribution piping system so that residents and businesses can receive drinking water while fires are being fought. In an Earthquake situation, residents and businesses may not receive continuous drinking water from the South Basin as fires are being fought, if there are breaks and/or leaks in the low-pressure drinking water pipes that connect to the South Basin. After the fires are put out, the Potable AWSS, connected to the North Basin, will be able to provide drinking water to the Sunset and Richmond Districts, even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

12) Will Sunset Reservoir be able to function after an earthquake? How long will it take for the water supplying Sunset Reservoir to arrive to the reservoir if there is a major earthquake?

In 2008, seismic improvements to the North Basin of Sunset Reservoir were completed for $64 million under the SFPUC's Water System Improvement Program (WSIP). Also under the WSIP, seismic improvements were made on the pipelines leading to Sunset Reservoir. **Thus, it is anticipated that the reservoir can be replenished from the Hetch Hetchy Water System within 24 hours of a major seismic event. Therefore, the Hetch Hetchy Water System will be able to re-fill the North Basin of the Sunset Reservoir prior to the Potable AWSS draining it after 4.5 days of use.**

The Hetch Hetchy Water System consists of 9 reservoirs, capable of supplying up to 265 million gallons of water per day. The WSIP includes $4.8 billion in upgrades to the system, increasing its seismic reliability and ability to provide water to the Bay Area after a large earthquake.

13) The Pacific Ocean is right next to the Westside of San Francisco. Why aren't we filling the Potable AWSS from there? Doesn't the AWSS use Bay Water?

The primary water source for the existing AWSS is the 10 million gallon Twin Peaks Reservoir, 0.5 million gallon Ashbury Heights Tank, and 0.75 million gallon Jones Street Tank. As part of the AWSS bond-funded projects, the Summit Reservoir, with its 11 million gallons of storage, can now be better used by the AWSS. This reservoir serves as a back-up, and would only be utilized by the AWSS during a large fire.

If additional water sources are needed, there are 2 seawater pump stations on the east side of San Francisco that can be utilized to supply a back-up water supply to the AWSS. There have been no known uses of these 2 stations during a fire since their installation in the early 1900s.

The Sunset Reservoir North Basin, with its large capacity and seismic reliability, provides an excellent, existing supply that can be used for the proposed Potable AWSS at no additional cost to rate payers. This reservoir is nine times larger than the existing Twin Peaks reservoir, the primary source utilized by the AWSS.

In the future, an existing SFPUC pump station at Lake Merced will be modified to pump Lake Merced water into new AWSS pipelines that will be installed by the Park Merced development project. Eventually, the Park Merced AWSS pipeline could be connected to the existing AWSS pipeline near Ocean Avenue. Current work will connect the 140 million gallon University Mound Reservoir to the existing AWSS.

The SFPUC is also analyzing new seawater pump stations that could be developed along Ocean Beach and by Hunters Point Shipyard, and will provide updates to the public as the analysis is completed. These future pump stations could serve as back-up supplies for the AWSS and Potable AWSS. Please note that the Potable AWSS would have to be converted to an AWSS if seawater was used, which would cause the system to lose the benefit of being a seismically reliable potable water distribution system for the Sunset and Richmond Districts.

16) How long will it take to install the Potable AWSS in the Sunset and Richmond District? I want fire suppression in the Westside of San Francisco ASAP.

The Potable AWSS is in the planning phase. Pipeline construction could begin in 2019 if the Management Oversite Committee gives direction to proceed with this project. SFPUC is requesting approval for funding of one mile of pipeline per year at $10 million per mile. Depending on the final length of Potable AWSS pipeline, the construction could be completed in four to eight years. A four-mile pipeline would take four years, while an eight-mile pipeline would take eight years. Each mile of pipeline installed provides significantly greater firefighting protection.

Please note that because the Potable AWSS option provides potable water benefits to the Sunset and Richmond Districts, bond funding **and** SFPUC rate payer funds could be used to pay for its implementation.

The same is not true if a traditional AWSS is deployed in the Sunset and Richmond Districts. Traditional AWSS systems can only utilize bond funding. Due to this distinction, a traditional AWSS would likely have a longer implementation timeline than a Potable AWSS because there is not enough bond funding in place to complete a traditional AWSS at this time. A Potable AWSS project could begin implementation more quickly using SFPUC rate payer funds.

18) How do population growth and new buildings affect firefighting reliability, and will AWSS be expanded to growing areas of San Francisco, such as new development areas in the east and southeast areas of San Francisco?

As new developments and population growth occur in San Francisco, the water required for firefighting to address post-earthquake fires may change. SFPUC is modelling the effects of new developments on AWSS capacity requirements, both within the new developments and in the City as a whole. The SFPUC and SFFD are working together to specify new AWSS piping and hydrants required within the new developments. Additionally, developers are required to contribute financing towards, or construct, AWSS facilities such as pipelines or pump stations, for additional firefighting needs. These requirements are specified in the Development Agreements approved by the Board of Supervisors for new, large development projects.

Appendix O

Project Name	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract
Cisterns	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**30**	**30**	
Physical Plant	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**4**	**10**	
Ashbury Tank									1		
Jones Street Tank									1		
Lake Merced Pumping Station - conventional AWSS	1										
Lake Merced Pumping Station - potable AWSS	1										
Pumping Station 1				1							
Pumping Station 2				1							
Twin Peaks Reservoir									1		
Twin Peaks Reservoir Joint Sealing									1		
Sunset Reservoir Pumping Station - potable AWSS	1										
University Mound Pumping Station - conventional AWSS								1			
Pipelines & Tunnels	**1**	**2**	**2**	**3**	**0**	**0**	**5**	**6**	**9**	**28**	
4th Street Connection							1				
Clarendon Supply			1								
Control System									1		
Fillmore & Haight								1			✓
Fort Mason Pier 2 Seawater Manifold								1			
Jones Street Tank Valves									1		
Pipeline Repairs									1		
Planning Study (CS-199)									1		
Pumping Station 1 Tunnel								1			
Seawater Fireboat Manifolds Evaluation									1		
Seawater Suction Connections									1		
Street Valve Motorization								1			
Twin Peaks Reservoir 16" Supply									1		
19th Avenue Pipeline			1								✓
Ashbury Bypass Pipeline				1							✓
Candlestick Point - Carroll Avenue									1		
Columbus & Green Pipeline									1		✓
FWSS - Lake Merced							1				
FWSS - McLaren Park Tanks							1				
FWSS - Street Crossings							1				
FWSS - Sunset Reservoir							1				
Ingleside Pipeline								1			
Irving Street Pipeline				1							✓
Lake Merced Pipeline		1									
Mariposa TFB Pipeline				1							
TFB Mission Rock - South Pipeline		1									
Westside Potable AWSS Pipeline	1										
University Mound East Pipeline								1			
Assessments	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**12**	
Ashbury Heights Valve House Evaluation									1		
Jones Street Tank Generator Foundation Evaluation									1		
Jones Street Tank Retaining Walls Assessment									1		
Jones Street Tank Valve House Evaluation									1		
ESER 2014 Project Recommendations									1		
Pipeline Network Surge Analysis									1		
Pumping Station 1 Foundation & Well Evaluation									1		
Pumping Station 1 Tunnel Evaluation (PS1 to bay)									1		
Pumping Station 2 Discharge Tunnels Evaluation									1		
Pumping Station 2 Well Evaluation									1		
Twin Peaks Reservoir Forebays Evaluation									1		
Twin Peaks Reservoir Tunnel Evaluation									1		
	4	2	2	5	0	0	5	7	55	80	
	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract

Appendix P

Candidate EFWS Projects

5/8/2019

Projects		Project Cost ($M) (2018 $)	No. of FRA's Directly Benefited	Hydraulic Power (MW)	Project Cost/MW ($M)	Scaling Factor to Lowest $/MW
Pipeline Projects						
1	Conv. AWSS PL - Diamond Street	4	1	0.7	6	1.0
2	Westside Seawater Supply PL			TBD		
3	Conv. AWSS PL - Lake Merced	4	1	0.1	25	4.2
4	Conv. AWSS PL - College Hill Supply	34	0	0.8	43	7.1
5	PEFWS	195	8	4.1	44	7.3
6	Conv. AWSS PL - Ingleside (Phase 1)	6	1	0.1	53	8.8
7	Conv. AWSS PL - Stanford Heights Supply	18	0	0.3	60	10.1
8	Conv. AWSS PL - University Mound East	23	4	0.4	67	11.2
9	Conv. AWSS PL - Ingleside (Phase 2)	14	1	0.2	78	13.0
10	Conv. AWSS PL - University Mound West	19	2	0.2	112	18.7
Subtotal Pipeline Projects		**317**		**6.8**		
Supply Projects						
1	Potable EFWS - Lake Merced PS	40	8	4.6	9	1.3
2	Conv. AWSS Lake Merced PS	10	2	1.5	7	1.0
3	Potable EFWS - Sunset PS	34	8	4.6	7	1.1
4	Conv. AWSS University Mound PS	20	10	2.6	8	1.2
5	Conv. AWSS Manifold - Pier 33-1/2	5	0	0.4	13	1.9
6	PS1 Well	2	0	0.1	13	2.1
7	Westside Seawater PS			TBD		
8	Conv. AWSS Manifold - Fort Mason Pier 1	8	0	0.4	21	3.1
9	Conv. AWSS College Hill Supply PS	25	0	1.0	25	3.8
10	Twin Peaks Forebays	6	0	0.2	26	3.9
11	Twin Peaks Tunnel	8	0	0.2	34	5.2
12	PS1 Tunnel (Phases 1 and 2)	13	0	0.3	43	6.6
13	Conv. AWSS Stanford Heights Supply PS	26	0	0.6	43	6.6
14	PS2 Discharge Tunnels	5	0	0.1	67	10.3
15	PS2 Well	4	0	0.04	89	13.7
Subtotal Supply Projects		**206**		**16.8**		
Infirm Zone Projects						
1	Conv. AWSS PLs - Infirm Zone 7	16	1	0.21	79	1.0
2	Conv. AWSS PLs - Infirm Zone 9	10	1	0.03	320	4.1
3	Conv. AWSS PLs - Infirm Zone 3, 4, 5	33	3	0.05	666	8.5
4	Conv. AWSS PLs - Infirm Zone 1, 2	32	2	0.04	790	10.1
5	Conv. AWSS PLs - Infirm Zone 6	18	1	0.00		
6	Conv. AWSS PLs - Infirm Zone 8	7	1	0.00		
7	Conv. AWSS PLs - Infirm Zone 10	19	1	0.00		
Subtotal Infirm Zone Projects		**135**		**0.3**		
Other Projects						
1	Conv. AWSS PL - PIPE - Bryant & 11th	16	0	0.15	104	1
2	Conv. AWSS PL - PIPE - Dolores & 20th	9	0	0.05	197	1.9
3	Conv. AWSS PL - PIPE - Brannan St.	36	0	0.04	953	9.2
4	Conv. AWSS PL - PIPE - Market St.	28	0	0.03	871	8.4
5	Ashbury Valve House	5	0			
6	Jones St Generator Foundation	1	0			
7	Jones St Valve House	5	0			
8	PS2 Remote Operation and Engine Repl.	12	0			
9	Miscellaneous Repairs	15	0			
10	Conv. AWSS PL - Surge Protection	4	0			
11	Conv. AWSS PL - Valve Renovation	6	0			
Subtotal Other Projects		**136**		**0.3**		
Development Projects						
1	Potrero PL	14	1			
2	Southern Area Supply Projects	166	5			
Subtotal Development Projects		**180**				
Grand Total		**974**		**19**		

1) MW=Hydraulic power (MW)
(1 MW = 1,341 hp)
2) S=Scaling factor to lowest $/MW

Appendix Q

Fire Dept.'s Ace in the Hole

By Jim Castleberry

The night of the Oct. 17 earthquake was not the first time the San Francisco Fire Department had to call on its Portable Water Supply System, but it was by far the most important.

When firefighters responded to a blaze in the Marina District, they were horrified to learn that *all the water lines in a 40 square block area surrounding the fire were broken and useless.*

With no water pressure, firefighters could only watch as the fire raged out of control and threatened to explode into the largest blaze in the city since 1906.

But the city had one more card to play – its ace in the hole.

Division Chief Harry Brophy issued the call for the Fireboat Phoenix and the department's Portable Water Supply System (PWSS).

For Assistant Chief Frank Blackburn, who developed the PWSS, and his fellow firefighters, it was the test they had been waiting for. The one that would determine once and for all if the PWSS, hailed as ingenious by some and a boondoggle by others, really worked. "I told the guys that this was the Super Bowl," Blackburn said.

Fortunately for the city, the PWSS performed perfectly.

As the Phoenix pumped water from the Bay, firefighters set up portable hydrants on Divisadero Street that allowed them to stretch hoses all the way to the fire at Beach Street.

Within an hour after the system was hooked up, the fire had been brought under control.

San Francisco's Board of Supervisors rewarded Blackburn with a commendation, thanking him not only for the development of the system but his quick work in putting it to use on Oct. 17.

"Without those portable hydrants, along with the fireboat, the city probably would have burned to the ground," Supervisor Terrance Hallinan said. "Blackburn knew where all the hydrants were and as soon as it hit, he rounded them up and set them into operation. It was a key to turning that whole situation around."

The key to the PWSS is the portable hydrant designed by Blackburn from old Gleeson pressure-reducing valves and other spare parts lying around the department's repair shop.

Using the hydrants, firefighters can pump from the Bay, a lake or underground cistern and lay a grid of hose covering several blocks.

The portable hydrants not only allow water pressure to be maintained, they also let firefighters hook up pumper trucks or fire hoses along the line so fires in multiple locations can be battled.

"Say there was a fire on Van Ness Avenue and all the water mains were broken," Blackburn said. "The PWSS would let you pump water from the Bay, all the way up Van Ness. People say it can't work, but it does. We proved it on Oct. 17."

Blackburn didn't start working on the portable hydrants and PWSS until 1984. By 1985 a prototype was ready and they were in regular use by 1986.

The PWSS helped put out a five alarm fire at First and Townsend street in 1987 and was also used at Hetch Hetchy later that year to protect buildings threatened by a fire burning in Yosemite National Forest.

"We drafted water from the Tuolumne River for that one," Blackburn said. "It's amazing. All you need is a body of water."

"It's something that San Francisco should really be proud of," said Dr. Charles Scawthorn, a researcher who has done extensive study of the risk posed to San Francisco by fire.

In 1987 Scawthorn wrote a report for the insurance industry on the conflagration risk in San Francisco following a major earthquake similar to 1906.

His report foresees widespread destruction with billions of dollars in property losses and dozens of major fires – similar in size to the Marina fire – after a magnitude 8.3 or larger quake.

"Everything that happened on Oct. 17 confirmed my findings," he said. "But the PWSS is obviously going to greatly improve the chance of the city surviving 'The Big One.' It won't save it entirely but at least we'll be able to limit the losses."

The Portable Water Supply System includes:

-- Four hose wagons that carry 4,000 to 5,000 feet of large, five inch diameter hose that connect to the portable hydrants (normal firehose is only three inches in diameter.

-- Underground cisterns located throughout the northern and eastern sections of the city that can be filled with water to supply trucks along the way.

-- Portable hydrants that allow water to flow freely for long distances at a very high pressure.

Scawthorn recommends a large-scale expansion of the PWSS.

"If there are only four hose wagons, you can only fight fires in four locations," Scawthorn said. "After a big quake there will be fires breaking out all over the city."

The Fire Commission has indicated its desire to expand the system and cleared the way for building of more cisterns in the outer Sunset and Richmond residential neighborhoods.

Plans are also underway to purchase more large-diameter hose, if the money can be found.

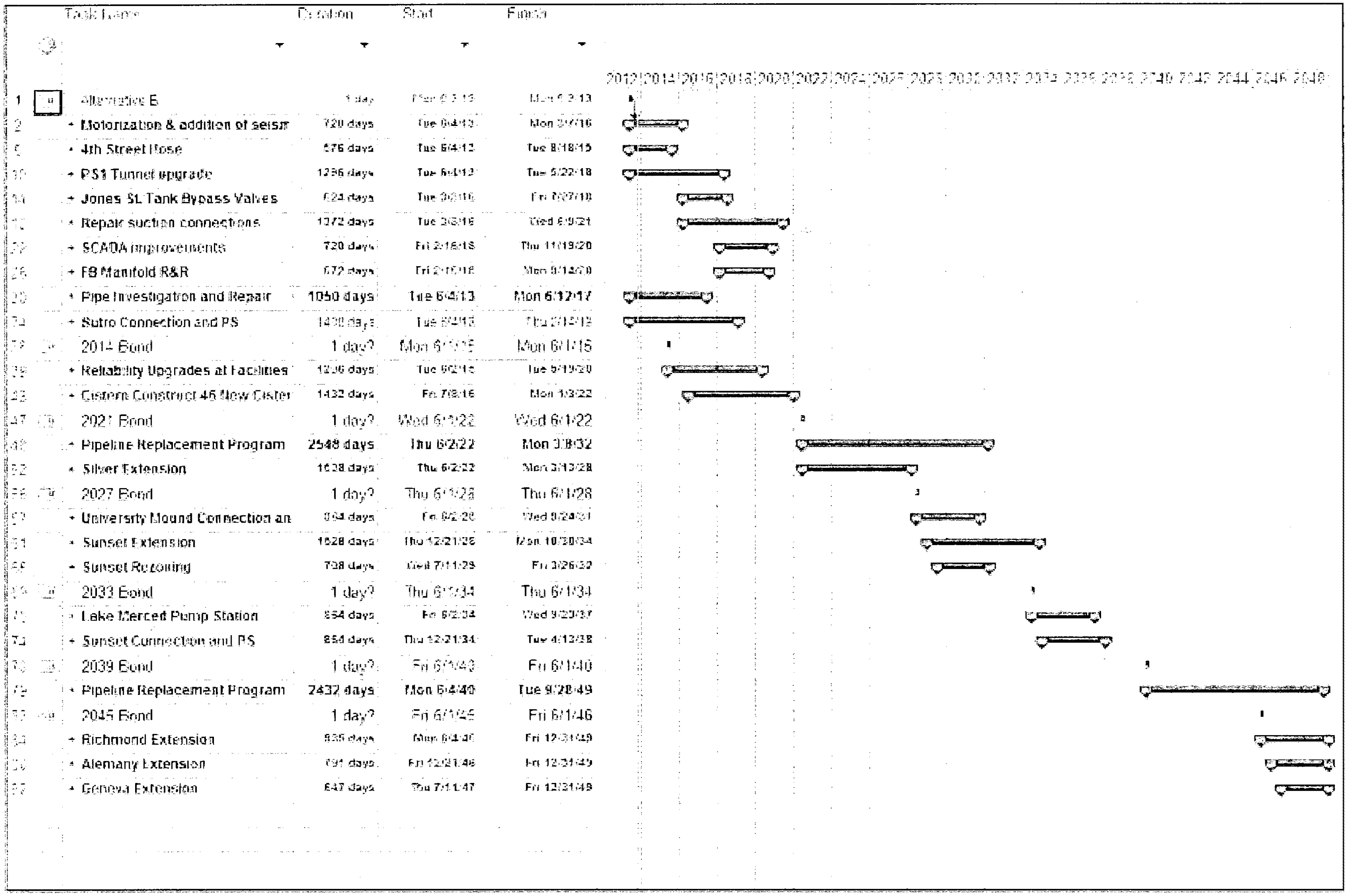
Blackburn calls it the best defense a city like San Francisco can have against fire following an earthquake.

"When a major quake occurs and water mains are broken, the answer is the PWSS," he said. "If you don't have it, you won't put the fires out."

1990 article on the Portable Water Supply System, an adjunct to the AWSS, and its use during the post-earthquake fires in October 1989.

Appendix R

Figure 5-1. Preferred Alternative Planning Level Schedule



Carroll, John (BOS)

From: Carroll, John (BOS)
Sent: Thursday, July 25, 2019 3:49 PM
To: BOS-Supervisors
Cc: BOS-Legislative Aides; 'Calvillo, Angela (angela.calvillo@sfgov.org)'; Somera, Alisa (BOS); Civil Grand Jury; Kittler, Sophia (MYR); Karunaratne, Kanishka (MYR); Power, Andres (MYR); Ma, Sally (MYR); Peacock, Rebecca (MYR); Rosenfield, Ben (CON); Rydstrom, Todd (CON); Stevenson, Peg (CON); Lediju, Tonia (CON); Newman, Debra; Campbell, Severin (BUD); Holober, Reuben (BUD); Millman Tell, Jennifer (BUD); Rasha Harvey; Lori Campbell; Kelly, Naomi (ADM); Khaw, Lynn (ADM); Strong, Brian (ADM); Raphael, Deborah (ENV); Gallotta, Peter (ENV); Sheehan, Charles (ENV); Nicholson, Jeanine (FIR); Ludwig, Theresa (FIR); Nakajo, Stephen (FIR); Conefrey, Maureen (FIR); Kelly, Jr, Harlan (PUC); Ellis, Juliet (PUC); Scarpulla, John; Whitmore, Christopher (PUC); Caen, Ann Moller (PUC); Hood, Donna (PUC); Mchugh, Eileen (BOS); GIVNER, JON (CAT)
Subject: 2018-2019 Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Categories: 190786, 190785

Supervisors:

Please find linked below the 2018-2019 Civil Grand Jury report, entitled: **Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System,** as well as a press release memo from the Civil Grand Jury and an informational memo from the Clerk of the Board.

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Civil Grand Jury Press Release - July 17, 2019

Clerk of the Board Memo - July 24, 2019

I invite you to review the entire matter on our Legislative Research Center by following the link below:

Board of Supervisors File No. 190785

Thank you,

John Carroll
Assistant Clerk
Board of Supervisors
San Francisco City Hall, Room 244
San Francisco, CA 94102
(415) 554-4445

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

MEMORANDUM

Date: July 24, 2019

To: Honorable Members, Board of Supervisors

From: Angela Calvillo, Clerk of the Board

Subject: 2018-2019 CIVIL GRAND JURY REPORT - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 17, 2019, the 2018-2019 Civil Grand Jury issued a press release, publicly announcing issuance of their report, entitled:

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 18, 2019, the Civil Grand Jury issued an updated report, including appendices which we inadvertently omitted from the July 17 public release.

Pursuant to California Penal Code, Sections 933 and 933.05, the Board must:

1. Respond to the report within 90 days of receipt, or no later than October 15, 2019; and
2. For each finding the Department response shall:
   - agree with the finding; or
   - disagree with the finding, wholly or partially, and explain why.
3. For each recommendation the Department shall report that:
   - the recommendation has been implemented, with a summary of how it was implemented;
   - the recommendation has not been, but will be, implemented in the future, with a timeframe for implementation;
   - the recommendation requires further analysis, with an explanation of the scope of the analysis and timeframe of no more than six months from the date of release; or
   - the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Pursuant to San Francisco Administrative Code, Section 2.10, in coordination with the Committee Chair, the Clerk will schedule a public hearing before the Government Audit and Oversight Committee to allow the Board the necessary time to review and formally respond to the findings and recommendations.

Continues on following page

The Budget and Legislative Analyst will prepare a resolution, outlining the findings and recommendations for the Committee's consideration, to be heard at the same time as the hearing on the report. These matters are anticipated for hearing in Government Audit and Oversight during a regular committee meeting in September 2019.

If you have any questions, please contact John Carroll, Assistant Clerk, at (415) 554 4445.

Attachments: July 17, 2019 Press Release; and
July 18, 2019 Updated Report: Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

FOR IMMEDIATE RELEASE

Contacts: Rasha Harvey, Foreperson, 415-716-8258
Stephen Garber, Committee Chairperson, 510-682-4693

***** PRESS RELEASE *****

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR EMERGENCY FIREFIGHTING WATER SYSTEM

San Francisco, CA, July 17, 2019 – San Francisco is notoriously vulnerable to fires following a major earthquake. Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system -- that provides excellent firefighting protection to parts of the City. However, the Civil Grand Jury found that large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS, and would be particularly vulnerable to fire damage when the next major earthquake strikes.

City leaders have known about this deficiency for decades, but have yet to develop concrete plans or a timeline to provide a robust emergency firefighting water supply for all neighborhoods. In 2014, the US Geological Survey estimated that there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043. Plans to develop a seismically safe high-pressure AWSS for the western portion of the City are now moving forward. However, at the City's current pace and funding levels, expansion of AWSS protections to inadequately protected neighborhoods will not be completed for 35 years or more – well after the USGS predicts that one or more major earthquakes will strike. The Civil Grand Jury, therefore, recommends that, by the end of 2020, the City present a detailed plan to extend AWSS protections to all neighborhoods, with an accelerated completion date of no later than 2034.

As an interim measure, the Grand Jury strongly recommends that the Mayor and the Board of Supervisors approve the San Francisco Fire Department's (SFFD) request to replace and expand its portable water supply system (PWSS). Comprised of specially equipped trucks ("hose tenders"), the PWSS can distribute pressurized water from many sources for long distances, and can be built and operational in one to two years. The Grand Jury recommends that these new PWSS hose tenders be strategically placed in Districts 1, 4, 7, and 11 -- neighborhoods lacking in AWSS protections. Although the Mayor's draft budget includes funds for 4 new hose tenders, this is barely sufficient to replace the current inventory of 5 tenders, all of which are past their useful lives.

The Grand Jury also recommends that the San Francisco Public Utilities Commission and the SFFD jointly develop "best practices" to ensure the proper maintenance of all AWSS assets, and that these agencies adopt and implement annual emergency response exercises, which include simulated earthquake drills using both AWSS and PWSS assets.

ACT NOW BEFORE IT IS TOO LATE

Experts tell us that San Francisco is overdue for another major earthquake like the one that devastated the City in 1906. Nevertheless, City officials have not prioritized plans to expand the high-pressure emergency firefighting water supply to all neighborhoods. This is a problem that threatens the lives and property of over one-third of our City's residents. City officials should make the expansion of emergency firefighting protections to all San Franciscans a matter of high priority, before it is too late.

Civil Grand Jury reports may be viewed online at http://civilgrandjury.sfgov.org/report.html.

###

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]								
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]								
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]								
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]			

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]		

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Angela Calvillo
Clerk of the San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Calvillo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Budget and Legislative Analyst
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Sir or Madam,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Sandra Lee Fewer
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Fewer,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Catherine Stefani
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Stefani,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Aaron Peskin
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Peskin,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RH

Rasha Harvey, Foreperson

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Gordon Mar
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mar,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Vallie Brown
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Brown,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Matt Haney
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Haney,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Norman Yee
President
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear President Yee,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

R H

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Rafael Mandelman
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mandelman,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Hillary Ronen
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Ronen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Shamann Walton
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Walton,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ahsha Safai
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Safai,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Naomi M. Kelly
City Administrator
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Brian Strong
Chief Resilience Officer
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mr. Strong,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RH

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Debbie Raphael
Director
San Francisco Department of the Environment
1455 Market Street, Suite 1200
San Francisco, CA 94103

Dear Ms. Raphael,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Jeanine Nicholson
Fire Chief
San Francisco Fire Department
698 Second Street
San Francisco, CA 94107

Dear Chief Nicholson,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Stephen Nakajo
President
San Francisco Fire Commission
1765 Sutter Street
San Francisco, CA 94115

Dear President Nakajo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

The Honorable London Breed
Mayor of San Francisco
City Hall, Room 200
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mayor Breed,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RLH

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Harlan L. Kelly, Jr.
General Manager
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear General Manager Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ann Moller Caen
President
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear President Caen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

400 McAllister Street, Room 008, San Francisco, CA 94102-4512 ◦ (415) 551-3635 ◦ http://civilgrandjury.sfgov.org/

TO THE BOARD OF SUPERVISORS
FROM JAMES DALESSANDRO -
September 19, 2019: File # #190786

AUTHOR OF "1906" and FILM MAKER OF "THE DAMNEDEST, FINEST RUINS"

DEAR SUPERVISORS: At five o'clock on the afternoon of April 19, 1906 - 36 hours after the catastrophic San Andreas fault rupture - 5 ships of the U.S. Navy's Pacific Squadron arrived at the Golden Gate to face a mountain of flames 1,500 feet high.

Utilizing their ships' massive steam pumps and an unlimited supply of saltwater, they stopped the fire along the entire Embarcadero – crucial to our rebuilding. They stopped the flames from leaping Van Ness Avenue, sparing the scant housing stock of Pacific Heights, the Fillmore, Sunset and Richmond Districts. They evacuated 100,000 desperate people on the waterfront. Over 38 hours, they pumped several hundred MILLION gallons of saltwater to check the fire's spread and save untold numbers of lives.

On October 17, 1989, following the Loma Prieta Earthquake, another naval vessel – our Fireboat Phoenix - pumped salt water onto the Marina fire for 14 hours, delivering 5 ½ MILLION gallons of salt water. It almost certainly prevented a repeat of 1906. Think of that for a moment, please - 5 ½ MILLION GALLONS OF SALT WATER to stop a single fire of only ¼ of a city block. If they had not stopped it there – where and how would they have stopped it?

So where are we today?

Despite 10's of millions of dollars from bond issues, provided overwhelmingly by San Francisco voters over the previous decades, 15 neighborhoods – 400,000 citizens – have no auxiliary, high-pressure water system to save homes, business, or lives. Why? Because the Public Utility Commission, which now controls the Auxiliary Water Supply System, has proposed one preposterous alternative after another to avoid expanding the AWSS. To further exacerbate our jeopardy, they have failed to maintain the EXISTING AWSS to where one seriously doubts its ability to function in an emergency.

Instead of expanding the AWSS, the PUC first proposed to buy 15 miles of cumbersome 12-inch hose. That was to be rolled out by the 24 on duty firefighters in the Sunset and Richmond Districts BEFORE they started fighting fires or rescuing citizens. Supervisor Peskin and others stopped that absurdity.

So now the PUC – instead of expanding the High Pressure SALTWATER SYSTEM with 3 pumping stations along the Bay and Pacific Ocean – is proposing that we co-mingle the POTABLE DRINKING WATER of the Sunset Reservoir with the brackish, POLLUTED WATER OF LAKE MERCED. The minute the Lake Merced Water enters

the MUNICIPAL WATER SUPPLY SYSTEM at least 400,000 people will be candidates for a wide variety of water born diseases.

Perhaps members of the PUC could drink unfiltered Lake Merced water for a week or two and let us all know how they fare? Or tell us how they plan to defend the massive lawsuits by our neighbors in the South Bay – who own 2/3rds of Sunset Reservoir's drinking water.

As you sit here today, the massive diesel pumping stations that supply the EXISTING AWSS – one station at Fort Mason, the other directly beneath the office of the Fire Chief on Townsend Street – are without an attendant capable of activating the system to supply salt water to the downtown's EXISTING high pressure hydrants.

The other parts of the EXISTING system, the levers and gates inside Jones Street on Nob Hill, which control nearly 12 million gallons of water from the Twin Peaks and Ashbury Heights Tanks – has not had an attendant on site in more than 20 years.

The PUC allegedly has someone somewhere who will control those massive Jones Street gates and valves and high-pressure water flow by means of a laptop computer. It is unclear what he or she knows about fire fighting, or how he or she would receive information on where that water is needed. It is also unclear if that system can deliver water, since some firefighters have stated the lack of regular flushing and maintenance has left hydrants clogged with sediment.

And now, our Mayor, a former Fire Commissioner, has cut $100,000 from the NERT budget – Neighborhood Emergency Response Team - curtailing the training of volunteers willing to risk their lives to rescue their neighbors.

I urge the Board of Supervisors to immediately appoint a Blue Ribbon Commission comprised of people who understand the science of fire suppression, and care about what happens to this city and its citizens. A Commission who will challenge the Public Utilities Commission and over ride the unconscionable support from some, but not all senior members of the Fire Department, past and present. The neglect and delays have pushed this city, its citizens and visitors to the brink of catastrophe.

The recent findings of the 2019 Civil Grand Jury, crying ACT NOW, come with an ominous footnote. Their findings echo those of the 2003 Civil Grand Jury. And of bond issues dating back to 1986 and 1908. The neglect of our current system by the PUC, and their preposterous ideas to further endanger us all, must be stopped.

It appears, dear Board, that the task is yours as the last vestige of hope and sanity.

James Dalessandro

From: aeboken
To: Mar, Gordon (BOS); Peskin, Aaron (BOS); Haneystaff (BOS); Calvillo, Angela (BOS); Somera, Alisa (BOS); Carroll, John (BOS)
Subject: GAO Meeting 7/16/20 Public Comment
Date: Thursday, July 16, 2020 11:25:01 AM

TO: GAO Committee members, Clerk of the Board

Please be advised that I was prepared to give public comment during the GAO hearing on the Civil Grand Jury report Act Now Before It's Too Late..

I was viewing the hearing on SFGovTV to see the PowerPoint presentation and hear Supervisor Mar's questions then immediately switched over to the call in line.

By then it appears that it was too late. I was unable to comment on the item.

I then spoke with the Clerk of the Committee to express my displeasure.

He did listen to my feedback. He also stated that the item would come before the GAO again in 6 months. My response was that my comments were time sensitive and the 6 month hearing would be too late.

Below are the Public Comments that I intended to make.

Eileen Boken with SPEAK and CSFN.

Speaking on my own behalf.

First I would correct the SFPUC presentation. Hetch Hetchy is the *initial* supply not the *primary* supply of the Emergency Firefighting Water System. This information comes directly from a retired firefighter familiar with the system.

Next, expanding the Emergency Firefighting Water System aka AWSS to the Westside already has a shovel-ready project.

This is Phase 2 aka Phase B of the L-Taraval Muni Forward project. This phase goes from Taraval and Sunset to Ulloa and Forestside.

As the L-Taraval project includes the replacement of water and sewer lines, Phase 2 could be amended to include dedicated, high pressure, high volume, non-potable water AWSS.

AWSS on Taraval and Ulloa has the support of SPEAK, the Coalition for San Francisco Neighborhoods, the Taraval Parkside Merchants aka POPS and the Great

West Portal Neighborhood Association.

Regarding the 10-Year Capital Plan, comments were submitted opposing the 10-Year Capital Plan as currently drafted.

The description for the Emergency Firefighting Water System specifies the potable water option. This appears both in the line item description and in the full description.

This is despite the Board's commitment to exploring other options as well as exploring the potable water option.

Sent from my Verizon, Samsung Galaxy smartphone

From:	Morten
To:	Mar, Gordon (BOS); Peskin, Aaron (BOS); Haney, Matt (BOS); Carroll, John (BOS)
Cc:	Elsbernd, Sean (MYR); Nancy Wuerfel; Tom Doudiet; Carroll, Maryellen (DEM); Strong, Brian (ADM); Dick Morten
Subject:	Comments on the Emergency Firefighting Water System (EFWS) Fiscal Year 2019/2020 Annual Report
Date:	Tuesday, July 14, 2020 7:08:16 PM

July 14, 2020

TO: Supervisors Mar, Peskin and Haney

FROM: Dick Morten

SUBJECT: Comments on the Emergency Firefighting Water System (EFWS) Fiscal Year 2019/2020 Annual Report

It is a fact the major firefighting tool of the Fire Department is: UNLIMITED WATER.

It is astonishing that for decades the Fire Department has not aggressively pursued unlimited fire fighting water. There are ample incidents (Marina and Loma Prieta fires, Pier 45 and other wharf side fires, Mission Bay and Squat and Gobble fires) where the department has had to use unlimited water supply resources found in the Auxiliary Water Supply System (AWSS). The department's mission certainly must include obtaining adequate fire fighting water resources. No other city department has that responsibility.

Transfer of AWSS to the SFPUC does not eliminate the obligation for SFFD to demand citywide expansion of multi-resource (domestic, saltwater and lake water) unlimited water supplies for firefighting. The Fire Commission, two Civil Grand Jury reports, Mayor's Office, CAPPS report, voter approved Bonds and numerous other calls to action have been ignored by the Fire Department. Why?

The Report by changing the title of the system to deliver high pressure firefighting water from Auxiliary Water Supply System (AWSS) to Emergency Fire Water System (EFWS) deliberately obfuscates the fact that EFWS *does not* deliver unlimited seismically safe firefighting water supply to neighborhoods citywide.

The Report ignores the Board of Supervisors Resolution identifying "Preparedness" as an integral objective of this Report. Does it really take a year to rattle off a list of projects, yet ignore Preparedness as a report goal?

The Report was to have four department authors. Only SFPUC and SFFD submit the Report. Where ares the response of Department of Emergency

Management and Office of Capital Planning?

The Report does not provide any program to provide unlimited, high pressure fire fighting water to non-AWSS districts. Where is the study for adding a saltwater pump station at Ocean Beach as required by the BOS resolution? Where does the Report discuss a Bayview saltwater pump station or a pump station at Lake Merced (designated by the State as firefighting water without a method to access this resource) to provide unlimited water? When will we become serious about developing unlimited high pressure fire fighting water? Does the Fire Department care?

The Report totally fails to implement the major recommendation of the 2019 Civil Grand Jury:

The City should aggressively develop a high-pressure, multi-sourced, seismically safe emergency water supply for those parts of the City that don't currently have one, with a target completion date of no later than 2034;

The Report does not map the ESER Bond projects, especially any expansion of high pressure firefighting water citywide. It must be a conscious effort to not map Bond projects because it would show the abject failure to implement the three ESER bond measures that promised voters citywide AWSS expansion. Granted, Bond funds have been expended to upgrade the existing AWSS system, but upgrades do not expand the fire protection coverage to the remainder of 13 non-AWSS districts that are without unlimited, high-pressure firefighting water. Where is the Resolution's required "detailed analysis of emergency firefighting water needs by district?"

Don't these districts warrant AWSS coverage?

The Report ignores the Local Hazard Mitigation Plan citation from the City's consultant, Applied Technology Council, who reported on post earthquake firefighting in San Francisco. The Council's citation is included verbatim in the Plan with a critical exception that *dropped* the report's discussion of firefighting water and the recommendation for a third AWSS pump station *"to provide additional water supply for post earthquake Firefighting, particularly for the western and southern portions of the City."* Why?

Is there a pattern developing of avoidance to address unlimited high pressure water supply from saltwater, domestic and fresh water resources? The answer is yes!

The Report fails to identify any projects for the recently approved ESER Bond. Leaving out specific projects left the voters without any idea what would be built. Instead voters were asked to approve a "Blank Check". This leaves projects to the inept SFPUC and SFFD to conduct needs assessment, establish project priorities, conduct environmental analysis, cost estimation, develop, etc. For years these same departments have stonewalled expansion of AWSS citywide. Now they have Bond monies to do what they want. Where is the evidence that they are to be trusted to deliver on AWSS promises? Will the City continue to deceive the voters and jeopardize our neighborhoods!

The Report doesn't provide any insight as to why SFPUC and its accomplice, SFFD, slow walk to the point of ignoring decades of Grand Jury and other reports calling for the expansion of AWSS citywide. Why is there such an aversion?

The Report has an over-reliance on the domestic/Hetch Hetchy water supply system. Yes, billions have been spent to seismically strengthen the Hetch Hetchy water system while the domestic system remains prone to major rupture even under normal circumstances today. Imagine the broken domestic pipe system feeding hydrants after a major quake. Scary!

The Report's Hetch Hetchy over-reliance ignores the fact that the SFPUC, through the state Water Code 73500, is required to share our locally stored water in an emergency (e.g., earthquake) from the three Terminal Reservoirs located in the city with our peninsula customers. This means water to fight fires in San Francisco will be seriously compromised by a legal obligation to send water south. Why doesn't the Report address this legal obligation?

Imagine citywide urban conflagrations following a major earthquake. The recent Pier 45 fire was quelled by about half the on duty firefighters utilizing AWSS assets (hose tenders, high pressure saltwater AWSS hydrants, fire boats) that are largely confined to the northeast part of the city. It is likely significantly more damage and potential injury and loss of life could have happened without AWSS. How will the raging earthquake generated fires be contained?

Pier 45 is a microcosm of the earthquake fire borne disaster awaiting San Francisco. Our collective complacency will be noted in any After Action Report. We have been warned time after time with no action.

The Report the mentions the recently adopted 10 Year Capital Plan without any discussion of AWSS expansion. Not including the AWSS expansion means no money for AWSS expansion.

It is dereliction of duty to not have unlimited high pressure firefighting water in a 10 year capital plan which incidentally impacts directly other city preparedness plans.

The Report does not address how the city would deal with concurrent major disasters such as earthquake, pandemic and wildfires that impacts the region and state or other unforeseen incidents. It is a lack of imagination for the Report to fail to consider the responses required for two or more simultaneous major disasters. Using the city's domestic water supply system is folly leaving the city without abundant firefighting water and compromising drinking water supplies. Without an independent citywide AWSS program our worst nightmares could be upon us.

Lastly, the Report is silent on a key 2019 Civil Grand Jury recommendation:

As an interim measure, the City should immediately replace and expand its inventory of Portable Water Supply System (PWSS) hose tenders, which are comparatively cheap, can be acquired much more quickly than the high-pressure AWSS, and were essential in fighting the 1989 Loma Prieta fire, but are now past their useful life;

While the City is coping with a Pandemic budget it should not ignore the necessity of acquisition of PWSS units in the forthcoming budget. Without these PWSS units the city remains extremely vulnerable to dangerous urban conflagration potentially killing and injuring thousands while destroying residential and commercial structures as well as our tax base. San Francisco cannot afford such a destructive event when there are opportunities to mitigate the earthquake's seismic power.

It is time for the Board of Supervisors to seize the initiative from the bureaucracy which has failed citizens for decades. Hold city departments accountable for delivering on Bond promises made to voters and the Civil Grand Jury to expand AWSS citywide. Do it today!

Dick Morten

From:	Nancy Wuerfel
To:	Carroll, John (BOS)
Subject:	Fwd: Comments on "Fiscal Year 2019-2020 Annual EFWS Report" - GAO committee meeting July 16, 2020
Date:	Wednesday, July 15, 2020 9:02:45 AM

John Carroll:

I am resending this email since there may have been a problem with the first one. Please let me know if you have any questions.

Thanks,
Nancy Wuerfel

-----Original Message-----
From: Nancy Wuerfel <nancenumber1@aol.com>
To: gordon.mar@sfgov.org <gordon.mar@sfgov.org>; aaron.peskin@sfgov.org <aaron.peskin@sfgov.org>; matt.haney@sfgov.org <matt.haney@sfgov.org>; john.carroll@sfgov.org <john.carroll@sfgov.org>
Cc: MayorLondonBreed@sfgov.org <MayorLondonBreed@sfgov.org>
Sent: Tue, Jul 14, 2020 7:04 pm
Subject: Comments on "Fiscal Year 2019-2020 Annual EFWS Report" - GAO committee meeting July 16, 2020

Supervisors:

1) The city report reveals the lack of interest by the city departments named to respond to the Board's resolution declaring a "State of Urgency" to preserve the well being and safety of the city's inhabitants by EFWS preparedness to a major earthquake and fire. Please note the subject line of the annual report sent to the Board does not reference "preparedness" in the title, nor is this report "consolidated" with DEM, Office of Resilience and Capital Planning (ORCP), SFFD, and SFPUC. Only the latter two departments are included in the report.

2) Six months of planning time have been wasted in doing nothing to address the really important issues outlined by the Board. The resolution summarizes what must be done to respond to our State of Urgency to protect all neighborhoods in the event of a major earthquake and fire that threatens the entire city. The city report demonstrates the departments' unwillingness even to acknowledge the serious jeopardy that San Francisco is in, as stated in the Civil Grand Jury 2019 report, because we are not prepared to fight fires following an earthquake for a lack of unlimited water and the infrastructure to deliver auxiliary water citywide.

3) The city report does not show that any planning is underway NOW :
a) to develop a plan due on 12/31/21 describing a comprehensive EFWS action plan;
b) to complete a study due on 6/30/21 for adding an EFWS saltwater pump station on the western side of SF;
c) to complete a detailed analysis due on 6/30/21 of emergency firefighting water

needs by neighborhood; and

d) to analyze by 6/30/22 whether to propose a separate bond for development and implementation of EFWS projects.

All four city departments named must make it a top priority to produce the plans, study, and analyses by the deadlines in the BOS resolution.

4) Both ORCP and DEM are responsible for addressing the Board's preparation issues. ORCP has already failed to recognize in their revised 2019 Hazard Mitigation Plan the possibility of two disasters happening simultaneously and to propose how to handle dual mitigations. We are now in a pandemic and a major earthquake could happen any time, but ORCP has ignored planning for a concurrence of both catastrophes. DEM also has not commented on how they will accommodate all the new homeless victims displaced by fires following an earthquake, along with the existing homeless people, if there is not enough water to suppress the fires burning down the wooden residential buildings. Does DEM have a plan for the increased volume of homeless people while experiencing a pandemic? This level of complex planning takes time, and both ORCP and DEM need to start their work today.

5) The existence of the current Covid-19 pandemic is no excuse to exonerate all four city departments from beginning to comply with the Board's resolution to prepare for the State of Urgency. Indeed, city departments agreed back in the fall of 2019 to implement some of the Jury's recommendations and those departments should have already begun their planning to comply with the Jury's report to "Act Now Before It Is Too Late." The clear urgency to prepare for disaster predates the Board's actions and Covid-19.

6) The Capital Plan must include prioritizing funds for expanding the independent AWSS and accessing unlimited water. The Mayor should understand that her efforts to address the homeless crisis will need to also include preserving the existing housing that we now have by not allowing it to be consumed by earthquake-ignited fires from broken gas lines and uncontrolled conflagrations. The Mayor should use the G.O. Bond funding slot in the 2024 Capital Plan intended for homelessness to include funding to preserve housing from destruction by fire, as prescribed in the Board's resolution.

7) In Board Resolution 422-19 to the Presiding Judge of the Superior Court for the Civil Grand Jury, there is a reference to the city's commitment to purchase five PWSS hose tenders. The Board was told there was funding for this equipment in the FY 2019-2020 approved budget. The city report does not even mention that the Mayor cut two hose tenders from the budget, nor is there mention if the order for the first hose tender previously approved has been actually been placed. The PWSS equipment is essential to provide water in the many areas of the city that do not have access to the independent AWSS system.

8) The Mayor is essential to resolving our State of Urgency by :

a) immediately restoring the funds promised through both local and state level actions to purchase of five hose tenders; and

b) prioritizing funding for expansion of the independent AWSS and accessing unlimited water by building new pump stations as part of the 2024 G.O.Bond now being developed for homelessness, or as part of a separate G.O. Bond issued specifically for preparing to fight fires following an earthquake. If partial funding for fire suppression is achieved locally by the city, then we will be in a position to apply for additional money from state and federal sources.

9) I ask that the Government Audit and Oversight Committee recommend to the full Board of Supervisors that a new resolution be drafted to focus the four city departments on their responsibility to complete the planning they have agreed to perform to the Board in resolution 484-19 and to the Jury's Presiding Judge in resolution 422-19, and to urge them to comply with the requirements for the reports due on 6/30/21 .

Thank you for considering my comments.

Sincerely,

Nancy Wuerfel

From:	Tom Doudiet
To:	Mar, Gordon (BOS); Peskin, Aaron (BOS); Haney, Matt (BOS); Carroll, John (BOS)
Subject:	Analysis of 2019-2020 Annual EFWS System Report YES!
Date:	Tuesday, July 14, 2020 2:34:08 PM
Attachments:	Business As Usual 2.0.pdf

RE: Analysis of 2019-2020 Annual EFWS System Report

Dear Supervisors:

The report of June 25, 2020, by the SFFD and the SFPUC, in response to BOS Resolution No. 484-19, which called for **"a consolidated annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan for EFWS..."** , to be issued jointly by **four city agencies**, appears to be an attempt to avoid a frank discussion of the concerns raised by the July 2019 Civil Grand Jury Report in regard to the dismal level of the City's preparedness to meet the inevitable demands of fighting post-earthquake conflagrations in the fifteen San Francisco neighborhoods in which no AWSS hydrants currently exist.

First , the report comes from only two of the four City agencies identified by the BOS resolution as participants in the reporting process, with the DEM and the Office of Resilience and Capital Planning apparently not participating.

Second , the report in no way addresses the most urgent concerns expressed by the CGJ report, Findings F4, F5, F6, and F11, with which the BOS resolution specifically agreed.

Third , instead of reporting on any progress having been made toward planning for a comprehensive expansion of the AWSS hydrant system into the currently unprotected neighborhoods, the report merely summarizes current SFPUC mini-projects either planned, under construction or completed, none of which bear on the two most critical issues identified by the CGJ (lack of a citywide high-pressure hydrant system and urgency of completion).

Fourth , the report devotes many pages to chronicling SFFD drills and table-top discussions, including the names and unit numbers of participants, as well as routine maintenance, such as dredging in front of the saltwater intake tunnel for Pump Station #1 and replacing the chains that are attached to hydrant caps. It further details that 5" hose (PWSS) drills are being conducted, presumably with the three or four thirty-year old units that have yet to be replaced, and recounts that the Fireboat *St. Francis* was used at the recent Pier 45 fire. While all of these activities are necessary for the routine functioning of the SFFD, **none of these activities is in any way germane to the issue of the expansion of the AWSS into the currently unprotected neighborhoods.** One can only assume that devoting the majority of the pages of a nine page report to such non-essential information, when the BOS has requested a **serious** annual report on the progress toward addressing the concerns raised by the Civil Grand Jury, appears to be a sophomoric attempt to disguise a lack of progress toward a meaningful plan for a comprehensive AWSS expansion.

Fifth , I would be remiss if I did not correct a false statement on the part of the SFPUC and the SFFD. In regard to the source of water for the AWSS hydrants, the statement has been repeatedly made, and is repeated again in the present report, that: **"The primary source of water is the SFPUC's Hetch Hetchy regional water system, which supplies water to one reservoir and two storage tanks."** This is not a factual statement. The fact is that the Hetch Hetchy water is **not** the primary source of water, but only the **initial** source of water (some 11.5 million gallons total). After the two saltwater pump stations and the **three** fireboats (not two fireboats, as the report incorrectly states) are engaged, they can pump a combined 88,000 gallons **per minute** into the AWSS hydrant system. Therefore, clearly, **the primary (main) source of water for the high-pressure hydrant system is NOT Hetch Hetchy water, but saltwater.** Such off-handed inaccuracies on the part of the two agencies that should be taking the

findings of the Civil Grand Jury report most seriously is unacceptable.
I have attached a commentary that appeared in several neighborhood newspapers in those districts that are not protected by the high-pressure hydrant system. It was published in January 2020, following the official response by various City agencies to the findings of the Civil Grand Jury report. I include it here because I believe the Board of Supervisors must be aware of the game-plan that the SFPUC is following in regard to avoiding the expeditious completion of the AWSS expansion called for by the CGJ. I believe that it will shed light on the reason that Fiscal Year 2019-2020 Annual EWFS Report is so lacking in substance.
Thomas W. Doudiet,
Assistant Deputy Chief,
San Francisco Fire Department,
Retired

Business as Usual: City Agencies Will Ignore the Civil Grand Jury's Call for Quick Action to Expand the City's Auxiliary Water Supply System

Frank T. Blackburn, Assistant Chief, SFFD, Retired
Thomas W. Doudiet, Assistant Deputy Chief, SFFD, Retired

The Report of the Civil Grand Jury (July 2019), "*Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System",* should be given the prompt attention of the various City agencies named as respondents. These include the Mayor, the Fire Commissioners, the Fire Chief, the Public Utilities Commission. That the issue of the citywide expansion of the Auxiliary Water Supply System (AWSS) of high-pressure, high volume hydrants has been unresolved for many decades is an egregious example of dereliction of duty by multiple agencies of the City. Continual postponement of this expansion will result in the destruction by fire of at least half of the City following the next great Bay Area earthquake. The two most essential conclusions of the report are: (1) the AWSS must be expanded to protect all San Francisco neighborhoods; and (2) time is of the essence.

In their answer to the Grand Jury's finding that the AWSS expansion must be accomplished as soon as possible (since we don't know when the "Big One" will strike, but we do know that in 15 San Francisco neighborhoods there will be no water for the SFFD to use to fight the multiple fires that experts tell us are sure to merge into conflagrations) responding City agencies state the following:

"As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). **These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity.** All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city**. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously.**"

Translation: All these issues are of vital importance to the quality of life in San Francisco and all must be prioritized when we consider how to spend our public funds, so the AWSS expansion has to fall in line and wait for occasional funding through the Capital Bond process.

Therefore, the responsible City agencies will ignore the Grand Jury's call to rapidly implement a citywide AWSS expansion. Instead serial hybrid, piecemeal, neighborhood by neighborhood mini-expansions will take place using Capital Bond funds as follows: 2020, 2027, 2033, and so on out to 2049. So much for the Grand

Jury's call for a complete build-out into all currently unprotected neighborhoods by 2034. Oh, and it gets better – the PUC will be using our Earthquake Safety and Emergency Response Bond funds to build reinforced municipal water mains, not dedicated high-pressure, high-volume AWSS mains using the unlimited supply of seawater that surrounds the City on three sides, and which the existing AWSS has used quite successfully since 1913.

The agenda of the SFPUC is not to provide a system having an inexhaustible supply of water, which is the only certain means by which the SFFD will be able to control post-earthquake fires, but rather to use Earthquake Bond money to slowly replace their antiquated and fragile drinking water mains. That's why the citywide expansion of the AWSS can't be completed before mid-century – the SFPUC needs to hijack the earthquake bond money slowly, and relegating the AWSS expansion to piecemeal occasional funding, instead of one large dedicated funding source for a comprehensive expansion, will surreptitiously facilitate their agenda. If the "Big One" hits before the piecemeal expansion using drinking water is complete, oh well!

It is ironic that a single bond issue, passed by the voters in 1907, to design and build the original AWSS led to the installation of Twin Peaks Reservoir, 77 miles of high-pressure pipelines, two saltwater pump stations and 887 hydrants. The entire project was designed, completed and put in service in five years, and it is still in service 116 years later. In contrast, the SFPUC has had control of the AWSS for over nine years and no comprehensive expansion plan for the fifteen unprotected neighborhoods has yet to materialize. In fact, even though the Grand Jury has called for such a plan to be completed within a year, the SFPUC now has been given an additional year by the Board of Supervisors to "study the matter". If engineers over a hundred years ago, armed with only pencils, paper and slide rules could accomplish what they did in five years, how is it that our modern engineers can't at least copy what was done by 1913 and expand it into the outlying neighborhoods?

The simple answer is that providing a robust, dependable and inexhaustibly sourced high-pressure hydrant system made perfect sense to the engineers who had been eyewitnesses to the destruction of the City by fire in 1906. Their highest priority was to prevent this from ever happening again. The highest priority of the SFPUC seems to be using Earthquake Bond money to replace their decrepit drinking water mains, and telling the public that their substandard approach to expanding the AWSS will suffice when multiple simultaneous fires break out in the western and southern neighborhoods, assuming, of course that the next big earthquake will wait for them to finish their piecemeal projects sometime around 2049.

Hopefully at some future time someone can explain how San Francisco, "The City That Knows How", can get the $1.7 billion funding to enable the construction of a subway tunnel from South of Market to Chinatown, or can undertake what is said will be a $5 billion reconstruction of the seawall, but can't figure out how to fund perhaps a $1 billion citywide expansion of the original AWSS, that will actually enable the SFFD to keep half the City from burning down following the next big earthquake, and save (conservatively) $140 billion worth of residential housing that exists in the fifteen currently unprotected western and southern neighborhoods.

If 1% of the City's budget were allocated to the comprehensive expansion of the AWSS each year for the next ten years (a total of $1.2 billion), the urgent recommendations of the Grand Jury could be accomplished, and the entire City would be protected using the inexhaustible supply of seawater that surrounds us (and is literally at the doorstep of those neighborhoods that currently lack protection). Moreover, if we had engineers of the caliber of those that existed in San Francisco a hundred years ago, who understood how post-earthquake fires will literally destroy, in a matter of a few days, a city largely constructed of wood, we could avoid having to learn the history of 1906 all over again, which we surely will if the City agencies are allowed to ignore the recent findings of the Civil Grand Jury.

TO THE BOARD OF SUPERVISORS
FROM JAMES DALESSANDRO -
September 19, 2019: File # #190786

AUTHOR OF "1906" and FILM MAKER OF "THE DAMNEDEST, FINEST RUINS"

DEAR SUPERVISORS: At five o'clock on the afternoon of April 19, 1906 - 36 hours after the catastrophic San Andreas fault rupture - 5 ships of the U.S. Navy's Pacific Squadron arrived at the Golden Gate to face a mountain of flames 1,500 feet high.

Utilizing their ships' massive steam pumps and an unlimited supply of saltwater, they stopped the fire along the entire Embarcadero – crucial to our rebuilding. They stopped the flames from leaping Van Ness Avenue, sparing the scant housing stock of Pacific Heights, the Fillmore, Sunset and Richmond Districts. They evacuated 100,000 desperate people on the waterfront. Over 38 hours, they pumped several hundred MILLION gallons of saltwater to check the fire's spread and save untold numbers of lives.

On October 17, 1989, following the Loma Prieta Earthquake, another naval vessel – our Fireboat Phoenix - pumped salt water onto the Marina fire for 14 hours, delivering 5 ½ MILLION gallons of salt water. It almost certainly prevented a repeat of 1906. Think of that for a moment, please - 5 ½ MILLION GALLONS OF SALT WATER to stop a single fire of only ¼ of a city block. If they had not stopped it there – where and how would they have stopped it?

So where are we today?

Despite 10's of millions of dollars from bond issues, provided overwhelmingly by San Francisco voters over the previous decades, 15 neighborhoods – 400,000 citizens – have no auxiliary, high-pressure water system to save homes, business, or lives. Why? Because the Public Utility Commission, which now controls the Auxiliary Water Supply System, has proposed one preposterous alternative after another to avoid expanding the AWSS. To further exacerbate our jeopardy, they have failed to maintain the EXISTING AWSS to where one seriously doubts its ability to function in an emergency.

Instead of expanding the AWSS, the PUC first proposed to buy 15 miles of cumbersome 12-inch hose. That was to be rolled out by the 24 on duty firefighters in the Sunset and Richmond Districts BEFORE they started fighting fires or rescuing citizens. Supervisor Peskin and others stopped that absurdity.

So now the PUC – instead of expanding the High Pressure SALTWATER SYSTEM with 3 pumping stations along the Bay and Pacific Ocean – is proposing that we co-mingle the POTABLE DRINKING WATER of the Sunset Reservoir with the brackish, POLLUTED WATER OF LAKE MERCED. The minute the Lake Merced Water enters

the MUNICIPAL WATER SUPPLY SYSTEM at least 400,000 people will be candidates for a wide variety of water born diseases.

Perhaps members of the PUC could drink unfiltered Lake Merced water for a week or two and let us all know how they fare? Or tell us how they plan to defend the massive lawsuits by our neighbors in the South Bay – who own 2/3rds of Sunset Reservoir's drinking water.

As you sit here today, the massive diesel pumping stations that supply the EXISTING AWSS – one station at Fort Mason, the other directly beneath the office of the Fire Chief on Townsend Street – are without an attendant capable of activating the system to supply salt water to the downtown's EXISTING high pressure hydrants.

The other parts of the EXISTING system, the levers and gates inside Jones Street on Nob Hill, which control nearly 12 million gallons of water from the Twin Peaks and Ashbury Heights Tanks – has not had an attendant on site in more than 20 years.

The PUC allegedly has someone somewhere who will control those massive Jones Street gates and valves and high-pressure water flow by means of a laptop computer. It is unclear what he or she knows about fire fighting, or how he or she would receive information on where that water is needed. It is also unclear if that system can deliver water, since some firefighters have stated the lack of regular flushing and maintenance has left hydrants clogged with sediment.

And now, our Mayor, a former Fire Commissioner, has cut $100,000 from the NERT budget – Neighborhood Emergency Response Team - curtailing the training of volunteers willing to risk their lives to rescue their neighbors.

I urge the Board of Supervisors to immediately appoint a Blue Ribbon Commission comprised of people who understand the science of fire suppression, and care about what happens to this city and its citizens. A Commission who will challenge the Public Utilities Commission and over ride the unconscionable support from some, but not all senior members of the Fire Department, past and present. The neglect and delays have pushed this city, its citizens and visitors to the brink of catastrophe.

The recent findings of the 2019 Civil Grand Jury, crying ACT NOW, come with an ominous footnote. Their findings echo those of the 2003 Civil Grand Jury. And of bond issues dating back to 1986 and 1908. The neglect of our current system by the PUC, and their preposterous ideas to further endanger us all, must be stopped.

It appears, dear Board, that the task is yours as the last vestige of hope and sanity.

James Dalessandro

Print Form

Introduction Form

By a Member of the Board of Supervisors or the Mayor

Time stamp
or meeting date

I hereby submit the following item for introduction (select only one):

☐ 1. For reference to Committee. (An Ordinance, Resolution, Motion, or Charter Amendment)

☐ 2. Request for next printed agenda Without Reference to Committee.

☒ 3. Request for hearing on a subject matter at Committee.

☐ 4. Request for letter beginning "Supervisor [ ] inquires"

☐ 5. City Attorney request.

☐ 6. Call File No. [ ] from Committee.

☐ 7. Budget Analyst request (attach written motion).

☐ 8. Substitute Legislation File No. [ ]

☐ 9. Reactivate File No. [ ]

☐ 10. Question(s) submitted for Mayoral Appearance before the BOS on [ ]

Please check the appropriate boxes. The proposed legislation should be forwarded to the following:

☐ Small Business Commission ☐ Youth Commission ☐ Ethics Commission

☐ Planning Commission ☐ Building Inspection Commission

Note: For the Imperative Agenda (a resolution not on the printed agenda), use a Imperative Form.

Sponsor(s):

Clerk of the Board

Subject:

Hearing - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

The text is listed below or attached:

Hearing on the recently-published 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Signature of Sponsoring Supervisor: ______

For Clerk's Use Only:

190786

CITY AND COUNTY OF SAN FRANCISCO
BOARD OF SUPERVISORS
BUDGET AND LEGISLATIVE ANALYST
1390 Market Street, Suite 1150, San Francisco, CA 94102
(415) 552-9292 FAX (415) 252-0461

Policy Analysis Report

To: Supervisor Mar
From: Budget and Legislative Analyst's Office
Re: Status of Emergency Firefighting Water System Analysis
Date: December 2, 2020

Summary of Requested Action

Your office requested that the Budget and Legislative Analyst study the Emergency Firefighting Water System (EFWS) through an equity lens that includes analysis of what is needed in the western and southern neighborhoods to provide them with fire protection equal to the protection level currently covering the eastern and central areas of the City that are safeguarded by an independent EFWS and by access to unlimited saltwater through two 10,000 gallon per minute pumps; and issue a report to the Board no later than December 31, 2020 on (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and long term that include acquisition of the high priority hose tender equipment, suggestions for multiple funding sources to finance the equitable citywide fire protection, and a proposed timeline for project completion.

For further information about this report, contact Severin Campbell at the Budget and Legislative Analyst's Office.

Executive Summary

- The City is at risk for major fires following an earthquake. According to a 2014 study by the United States Geological Survey (USGS), San Francisco has a 72 percent chance of a magnitude 6.7 or larger earthquake (equivalent to the 1989 Loma Prieta earthquake) prior to 2043. According to a 1992 report to the National Science Foundation, the 1989 Loma Prieta earthquake caused 41 fires in San Francisco, largely due to electrical wiring and electric and gas appliances.
- The City's Emergency Firefighting Water System (EFWS) does not sufficiently cover all areas of the City, placing some neighborhoods at higher risk for fires after an earthquake. According to an analysis by the San Francisco Public Utilities Commission (SFPUC), 15 of 48 Fire Response Areas (FRAs) have reliability scores below 50 percent. This means that after a 7.8-magnitude earthquake these FRAs would have less than half the water supply necessary to meet the median firefighting demands. The western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited EFWS coverage, and generally have FRA scores of less than 50 percent.

- SFPUC has developed a plan to construct a potable EFWS system in the Sunset and Richmond Districts (EFWS Westside). The estimated cost of the EFWS Westside Phase I project is approximately $198 million, of which funding from the 2020 Earthquake Safety and Emergency Response (ESER) Bond and Water Enterprise revenues is available. This project is expected to be completed in 2025. Another potential project under consideration to improve EFWS coverage on the City's Westside is a saltwater pump station along the Pacific Ocean. The EFWS system currently has two saltwater pump stations along the Bayfront, but none along the Pacific coast.
- While the EFWS Westside Phase I project would significantly improve coverage on the City's Westside, there would still be system coverage deficiencies in the south and southeastern areas of the City. The Excelsior and Visitacion Valley neighborhoods had low reliability scores in the SFPUC analysis of FRAs. The Board of Supervisors, in response to the 2018-19 Grand Jury report, requested SFPUC to develop a comprehensive EFWS citywide plan by December 31, 2021. As part of the comprehensive citywide plan, the City Administrator's Office, Mayor's Budget Office, SFPUC, and San Francisco Fire Department (SFFD) are analyzing whether to propose a stand-alone ESER bond dedicated solely to funding subsequent phases of the EFWS project.
- In addition to the EFWS, the City maintains a Portable Water Supply System (PWSS) consisting of hose tender trucks to assist with firefighting operations in areas not covered by the EFWS. Funding is available in FY 2020-21 to purchase three new hose tender trucks.
- In response to the 2018-2019 Civil Grand Jury report, the Board of Supervisors has requested SFPUC to complete analyses by June 30, 2021 of (i) additional seawater pump stations in San Francisco, include seawater pump stations on the Westside of San Francisco; and (ii) neighborhood firefighting water demands. As noted above, the Board has also requested SFPUC to prepare a comprehensive EFWS citywide plan by December 31, 2021. Given the risk of fires, especially after an earthquake, and the lack of sufficient EFWS coverage in the western and south/southeastern section of the City, the Board should ensure presentation of these reports in public hearings.

Project staff: Reuben Holober, Severin Campbell

Current Risks to the City's Emergency Firefighting Water Supply

The City is at risk for major fires following an earthquake. According to a 2014 study by the United States Geological Survey (USGS), San Francisco has a 72 percent chance of a magnitude 6.7 or larger earthquake (equivalent to the 1989 Loma Prieta earthquake) prior to 2043. According to a 1992 report to the National Science Foundation, the 1989 Loma Prieta earthquake caused 41 fires in San Francisco, largely due to electrical wiring and electric and gas appliances. One block in the Marina district was destroyed by fires caused by a broken gas distribution line. When access to nearby fire hydrants and the Palace of Fine Arts lagoon was insufficient to fight the fire, the Fire Department accessed water from the Bay, in which the Phoenix fire boat and three hose tenders were employed. Fire crews set up four major runs of five-inch hose between the fire and the boat using nine portable hydrants. Before all fire operations were concluded in the Marina District, the boat pumped 6,000 gallons per minute for more than 18 hours.[1]

The City completed the first water system for firefighting in 1913, following the 1906 San Francisco earthquake. The original Emergency Firefighting Water System (EFWS, also known as the Auxiliary Water Supply System, or AWSS) system consisted of (i) 72 miles of water pipes, concentrated heavily in the northeast part of the City around downtown; (ii) 889 hydrants; (iii) the Twin Peaks Reservoir; (iv) Ashbury and Jones Street tanks; and (v) Pump Stations 1 and 2. In 2010, San Francisco Public Utilities Commission (SFPUC) assumed responsibility for the operations and maintenance of the EFWS.

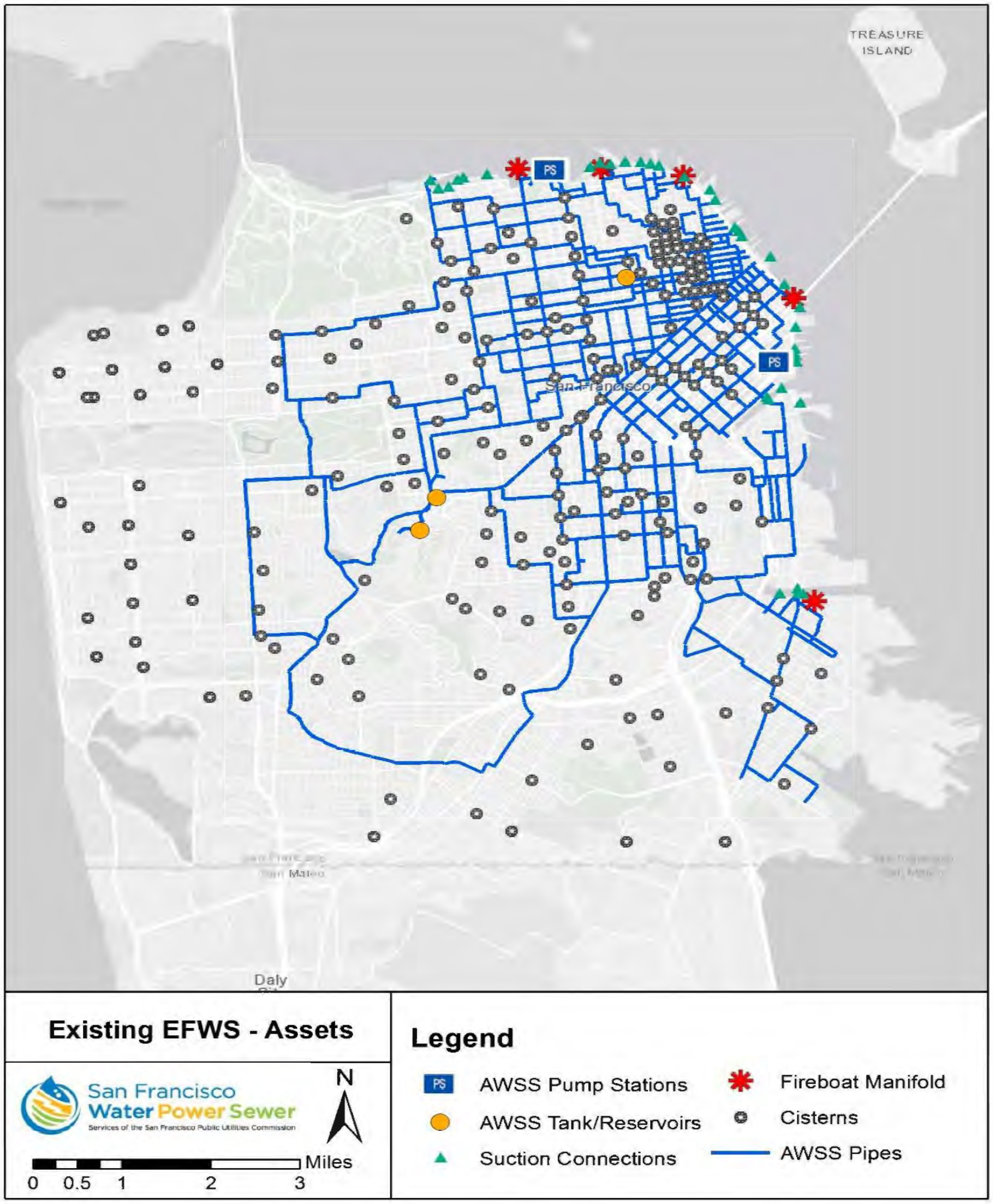
The EFWS has been expanded through funding from multiple bond measures over the years. The system now consists of approximately 130 miles of pipes, 229 cisterns, two pump stations, two water storage tanks, and a reservoir. The two seawater pump stations, as well as two fireboats, allow seawater from the San Francisco Bay to be injected into the EFWS. There are five manifolds that allow fireboats to inject seawater into the EFWS. There are 35 suction manifolds along the waterfront that allow seawater to be drawn from the bay and injected into the EFWS.

Limited Emergency Water Supply in Western and Southern Neighborhoods

The EFWS system is still heavily concentrated in the eastern half of the City, largely in the Downtown and South of Market areas. The western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited coverage. Furthermore, there are no pump stations in the western half of the City to pull water from the Pacific Ocean. Exhibit 1 below shows the existing EFWS system.

[1] *Investigation of Cause and Effects of Fires Following the Loma Prieta Earthquake*, Jamshid Mohammadi, Sam Aiyasin, D.N. Bak. Report to the National Science Foundation, 1992

Exhibit 1: Existing EFWS System Assets



Source: SFPUC

As shown in Exhibit 1, the western and southern parts of the City, including the Sunset, Richmond, Excelsior, and Visitacion Valley areas, have limited EFWS coverage.

Exhibit 2 below quantifies the existing EFWS assets by Supervisorial District.

Exhibit 2: EFWS Assets by Supervisorial District

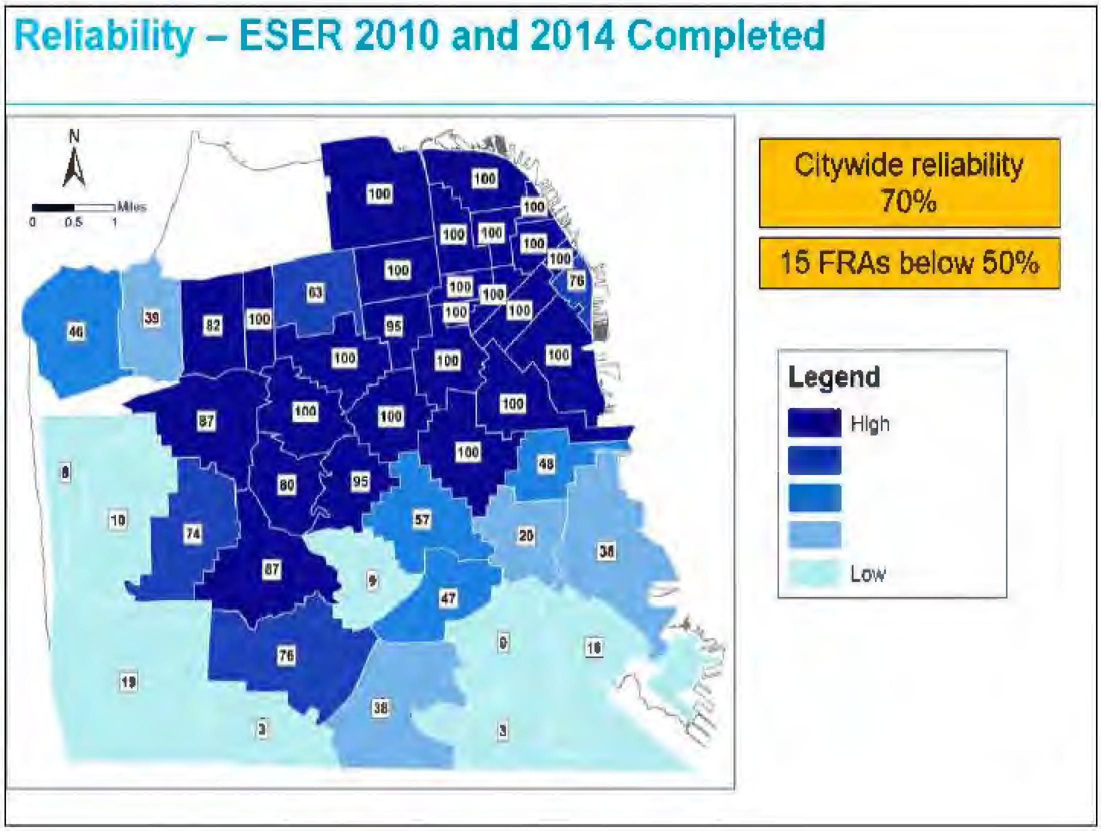
District	Number of EFWS Hydrants	Miles of EFWS Mains	Number of Cisterns
1	42	5	17
2	170	14	23
3	327	23	46
4	3	<1	12
5	188	16	20
6	366	27	26
7	79	7	12
8	110	9	27
9	110	9	21
10	222	18	20
11	24	1	5
Total	**1,641**	**130**	**229**

Source: SFPUC

Districts 1, 4, 7, and 11 have the fewest hydrants, miles of EFWS pipelines, and cisterns. District 4 has particularly poor coverage, with only three hydrants and less than 1 mile of pipeline. Conversely, Districts 3, 6 and 10 have the most hydrants, miles of EFWS pipelines, and cisterns.

SFPUC has conducted analysis to determine EFWS capability to meet median firefighting demands after a magnitude 7.8 earthquake. After voters approved Earthquake Safety and Emergency Response (ESER) bonds in 2010 and 2014, SFPUC was able to improve the EFWS system, including upgrading water supply reliability via projects at Twin Peaks Reservoir, EFWS tanks and pump stations, and adding 30 cisterns. Exhibit 3 below shows the EFWS reliability scores by Fire Response Area (FRA) following the 2010 and 2014 ESER bond improvements.

Exhibit 3: EFWS Reliability Score by FRA, Following 2010 and 2014 ESER Bonds Improvements



Source: SFPUC

The EFWS reliability scores by FRA largely mirror the map of the EFWS system buildout. Areas in the northeast portion of the City have high scores, while those in the western and southern portions of the City have lower scores. As noted in Exhibit 3, 15 FRAs have reliability scores below 50 percent. This means that after a 7.8-magnitude earthquake, these FRAs would have less than half the water supply necessary to meet the median firefighting demands.

By each of these metrics, it is clear that the western and southern portions of the City have the least sufficient water supplies needed for fires anticipated after a major earthquake. According to a fire modeling expert, the fire risk of a major earthquake subsumes the scope of all other types of fires possible in San Francisco, such as terrorist attacks, explosions, and wildfires.

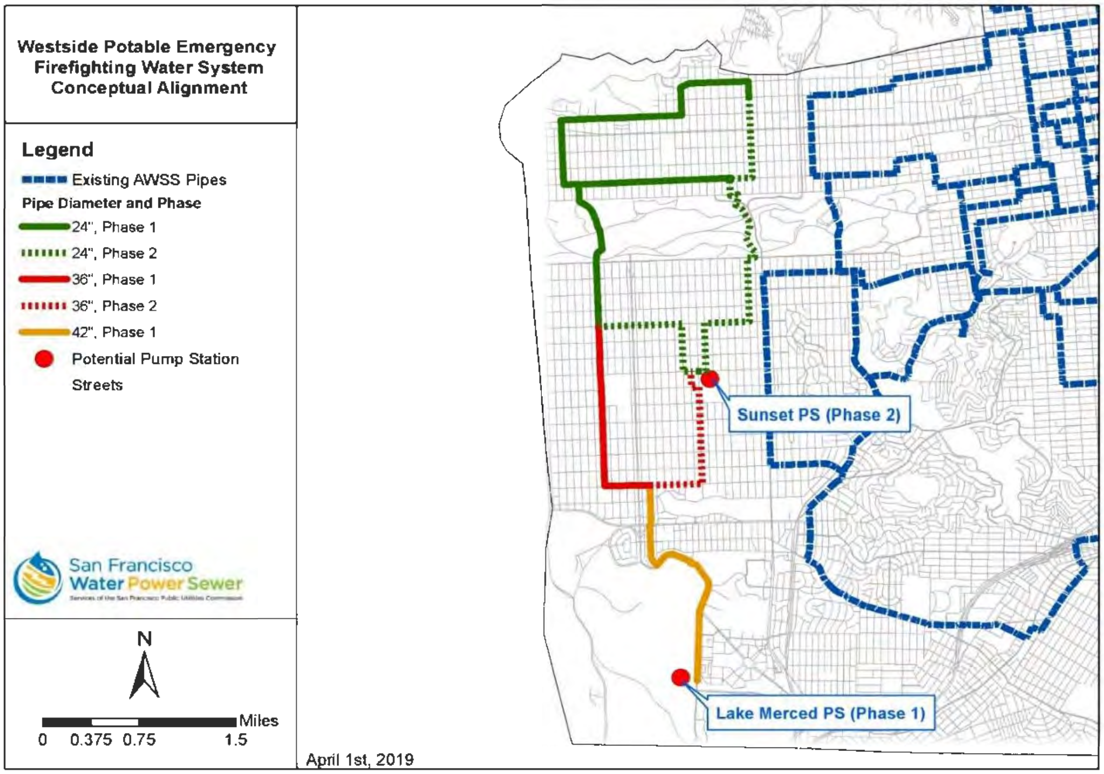
Options to Improve EFWS Access

Westside EFWS Options

In 2018, AECOM issued the report "Westside Emergency Firefighting Water System Options Analysis" on behalf of the SFPUC and San Francisco Fire Department (SFFD). The report analyzed 12 options for improving EFWS coverage in the Westside of the City. The options included both building off the existing EFWS system, or a potable EFWS system sourced from the Sunset Reservoir. Of the 12 options, the preferred option was Option 12, a potable EFWS system with a pump station at the Sunset Reservoir and loops around the Sunset and Richmond Districts. The estimated cost was approximately $109 million.

SFPUC has developed an updated conceptual Westside EFWS alignment based on Option 12 in the 2018 AECOM report. The key difference is that rather than only using Sunset Reservoir as a water source, the proposal would use Lake Merced as the primary source, and potentially use the Sunset Reservoir as a secondary source in a future project phase. Lake Merced contains approximately 1.2 billion gallons of water, while Sunset Reservoir only contains approximately 90 million gallons. However, Sunset Reservoir is supplied water via upgraded, seismically resilient pipelines that are connected to the SFPUC's Hetch Hetchy Regional Water System. The Westside EFWS Phase I project would connect Lake Merced to the Outer Sunset and Richmond neighborhoods, while Phase II would potentially connect a loop through the Inner Sunset and Richmond neighborhoods. A conceptual alignment of the Westside EFWS is shown in Exhibit 4 below.

Exhibit 4: Westside EFWS Conceptual Alignment



Source: SFPUC

The estimated cost of the EFWS Westside Phase I project is approximately $198 million. In March 2020, San Francisco voters approved Proposition B, a $628.5 million ESER bond that includes approximately $153.5 million for EFWS projects. The ESER bond funding, as well as approximately $55 million in Water Enterprise revenue bonds, totaling $203.5 million, provide sufficient funding to complete the EFWS Westside Phase I project by 2025, pending California Environmental Quality Act (CEQA) review. The issuance of up to $85 million in 2020 ESER bonds is currently pending Board of Supervisors approval (File 20-1295), and SFPUC anticipates receiving $20 million of the initial bond proceeds, which will be used for planning, design, and CEQA review for the Westside Phase I project and manifold projects at Fort Mason and Pier 33 ½.[2]

The estimated cost of the potential EFWS Westside Phase II project is $180 million for which funding has not yet been identified.

Another potential project that may improve EFWS coverage on the City's Westside is a saltwater pump station along the Pacific Ocean. The EFWS system currently has two saltwater pump stations along the Bayfront, but none along the Pacific coast. In response to the Civil Grand Jury report, the Board of Supervisors has directed

[2] The remaining $543.5 million in ESER bonds will likely be issued starting in the first half of 2021, with an initial sale of approximately $150-175 million. Of the remaining 2020 ESER bonds, $133.5 million is allocated to EFWS projects. The estimated cost in 2019 $s for the potential EFWS Westside Phase II is $180 million.

SFPUC to complete a study analyzing additional seawater pump stations in San Francisco, include seawater pump stations on the Westside of San Francisco by June 30, 2021.

Other EFWS Options

While the EFWS Westside Phase I project would significantly improve coverage on the City's Westside, there would still be system coverage deficiencies in other portions of the City, including the southeastern areas of the City. The Board of Supervisors has directed SFPUC to complete a more detailed analysis of neighborhood firefighting water demands by June 30, 2021, as well as a comprehensive EFWS citywide plan by December 31, 2021. As part of the comprehensive citywide plan, the City Administrator's Office, Mayor's Budget Office, SFPUC, and San Francisco Fire Department (SFFD) are analyzing whether to propose a stand-alone ESER bond dedicated solely to funding subsequent phases of the EFWS project.

Hose Tender Equipment

In addition to the EFWS, the City maintains a Portable Water Supply System (PWSS) to assist with firefighting operations in areas not covered by the EFWS. The PWSS consists of hose tender trucks that are equipped with approximately one mile of five-inch diameter hose, a portable pump, portable hydrants, and other firefighting equipment. Each fully equipped hose tender costs approximately $1 million. SFFD currently has five tenders, and all are between 28 and 47 years old and beyond their useful lives. These tenders are only able to transport hose and equipment and do not have pumping capabilities.

The FY 2019-20 budget included $4 million for four additional hose tenders, and SFFD also received $1 million in funding from the California Office of Emergency Services to purchase an additional hose tender, totaling $5 million for purchase of five hose tenders. However, due to the City's budget deficit from the COVID-19 pandemic, $2 million was reduced by the Mayor's Budget Office as part of the mid-year balancing plan. That leaves $3 million remaining to purchase three new hose tenders, and the units are currently out to bid by the Office of Contract Administration. These new hose tenders are more efficient and maneuverable than older models. They contain pumps that can siphon water from the Bay, reservoirs, or other sources. The hoses can be connected to carry water several miles from the source. The City Attorney's Office has determined that ESER bonds may not be used to purchase hose tender equipment, so they must be purchased from the General Fund or grant funds.

Emergency Firefighting Water System: Annual Report FY 2019-2020

John Scarpulla, SFPUC
Heather Green, Office of Resilience and Capital Planning

San Francisco Water Power Sewer

ONESF Building Our Future

EFWS per Bond Report

The selection of ESER 2020 projects will be guided by the system's technical steering committee, which consists of senior technical and operational managers from the Fire Department, Public Works and the San Francisco Public Utilities Commission. The Management Oversight Committee, which includes the fire chief, Public Works director, general manager of the San Francisco Public Utilities Commission and the assistant general manager of the Water Enterprise of the San Francisco Public Utilities Commission, will determine the list of ESER 2020 projects. The recommendations and decisions of these two committees will take into consideration the findings of the California Environmental Quality Act (CEQA) environmental review process.

San Francisco Water Power Sewer

ONESF Building Our Future

What is the EFWS?

- Emergency Firefighting Water System (EFWS): A high-pressure fire-suppression water system built after 1906 earthquake.
- Hetch Hetchy Regional Water System = Primary Source of Water
- EFWS ownership transferred to SFPUC in 2010
- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works
- Hydraulic modeling utilized to guide decision making.

San Francisco Water Power Sewer

ONESF Building Our Future

Resolution 484-19

- Urged the following:
  - By June 30, 2021: complete a study analyzing EFWS seawater supplies.
    - In Progress
  - By June 30, 2021: complete a more detailed analysis of neighborhood firefighting water demands.
    - In Progress
  - By December 31, 2021: develop a comprehensive citywide EFWS plan.
    - In Progress
  - **Annual Report submitted each June 30.**

San Francisco Water Power Sewer

ONESF Building Our Future

Annual Report – FY 19-20: EFWS Used at Fires

- **Feb 29, 2020:**
  - Toland St. & Evans St.
  - 4 Alarm Fire

- **May 23, 2020:**
  - Pier 45
  - 4 Alarm Fire

San Francisco Water Power Sewer

ONESF Building Our Future

Annual Report – FY 19-20: Capital Projects

- **Completed:**
  - Ashbury Bypass EFWS Pipeline
  - Terry Francois & Mariposa EFWS Pipeline
  - Irving Street EFWS Pipeline
  - Pump Station No. 1 Upgrades

- **Under Construction:**
  - Pump Station No. 2 Upgrades

- **Construction in FY 20-21:**
  - 19th Ave EFWS Pipeline
  - Clarendon Supply EFWS Pipeline
  - Terry Francois/Mission Rock/Warriors Way EFWS Pipeline

- **Additional work in FY 20-21:**
  - Westside Potable EFWS: Environmental Review, Planning, and Design
  - Street Valve Motorization: Bidding

San Francisco Water Power Sewer
ONESF Building Our Future

Annual Report – FY 19-20: Development Projects

- **Installed EFWS Infrastructure**:
  - Pier 70
  - HopeSF Sunnydale
- **Development Agreement Approved With EFWS Infrastructure:**
  - Potrero Power Station
  - 3333 California Street
- **Development Agreement With EFWS Infrastructure Pending Approval:**
  - Balboa Reservoir

San Francisco Water Power Sewer

ONESF Building Our Future

Annual Report – FY 19-20: Maintenance

- **Over 27,000 hours of maintenance performed on the City's Firefighting Water Infrastructure.**

- **Highlighting Tasks:**
  - Hydrant Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Seawater Suction Connection Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Reservoir and Cistern Inspections and Preventive & Corrective Actions (Joint with SFFD)
  - Fixing Pipeline Leaks
  - Pump and Generators Inspections and Preventive & Corrective Actions
  - Valve Inspections and Preventive & Corrective Actions

San Francisco Water Power Sewer

ONESF Building Our Future

Annual Report – FY 19-20: Drills, Special Projects, and Meetings

- Pier 90 Seawater Manifold Drill (SFFD & Fireboat & SFPUC)
- Bay Bridge Pump Station & Standpipe Drill (SFFD & SFPUC)
- 5" Hose Tender Drills (SFFD)
- SFFD & SFPUC 5" Hose Tender Drill (*planning completed*)
- Bay Dredging Near Seawater Inlets (SFFD & Port)
- SFFD & SFPUC Joint Agency EFWS Meetings
- SFFD & RPD Joint Agency Meetings

San Francisco Water Power Sewer

ONESF
Building Our Future

Updating SFPUC/SFFD MOU

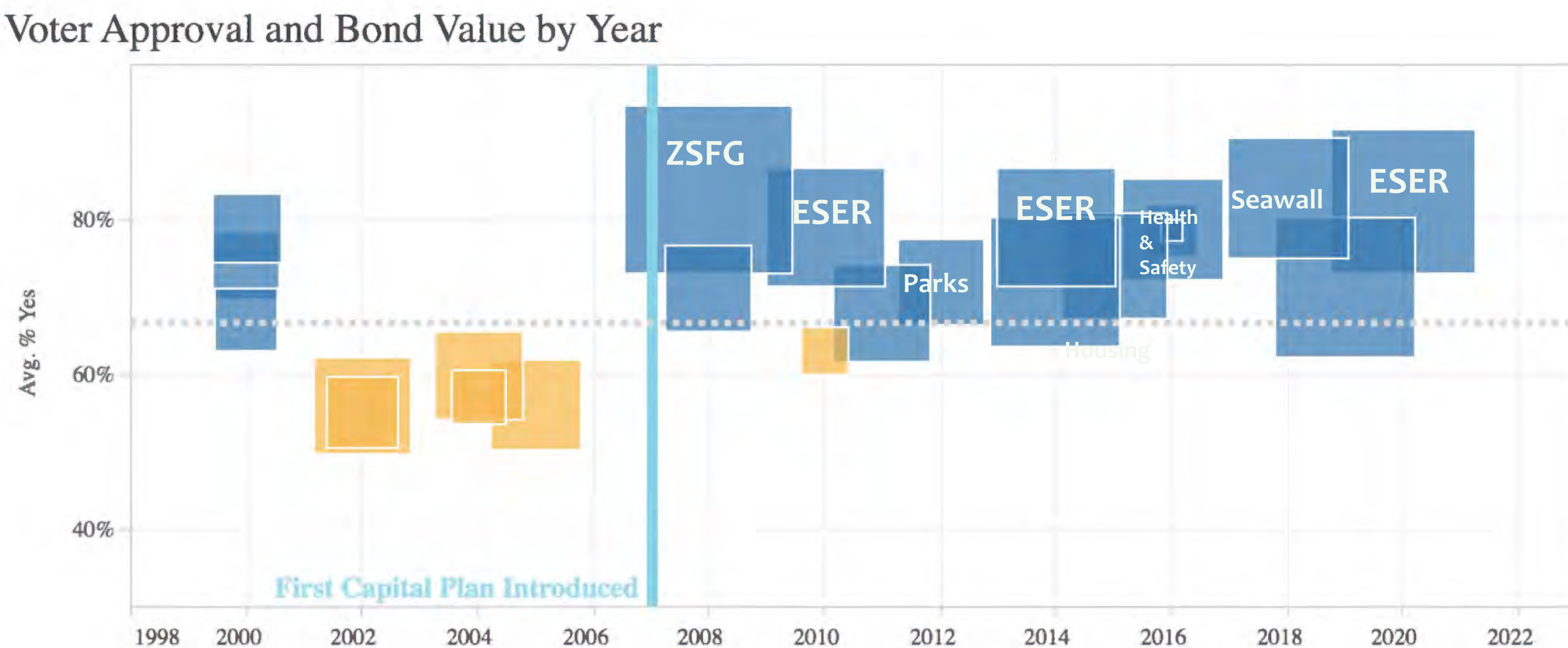
- *Memorandum of Understanding Regarding the Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression*

  - Signed in 2015 by SFFD and SFPUC
  - Updating it to better detail and memorializing exercises and drills utilizing EFWS
  - Expected to be completed in 2020.

San Francisco Water Power Sewer

ONESF Building Our Future

Voter Approval of G.O. Bond Measures since 2000



San Francisco Water Power Sewer

ONESF Building Our Future

ESER 2020 Bond Programming

- $628.5M total
- **$153.5M Emergency Firefighting Water System (EFWS)**
- $275M - Fire Training and Station Facilities
- $121.5 - Police Station Facilities
- $70M - Disaster Response Seismic Improvements
- $9M - 1011 Turk (911 Call Center)

San Francisco Water Power Sewer

ONESF Building Our Future

Questions?

San Francisco Water Power Sewer

ONESF Building Our Future

File No. 190785

Committee Item No. 1
Board Item No. ____________

COMMITTEE/BOARD OF SUPERVISORS

AGENDA PACKET CONTENTS LIST

Committee: Government Audit and Oversight **Date:** July 16, 2020
Board of Supervisors Meeting: **Date:** ____________

Cmte	Board	
☐	☐	**Motion**
☐	☐	**Resolution**
☐	☐	**Ordinance**
☐	☐	**Legislative Digest**
☐	☐	**Budget and Legislative Analyst Report**
☐	☐	**Youth Commission Report**
☒	☐	**Introduction Form**
☐	☐	**Department/Agency Cover Letter and/or Report**
☐	☐	**MOU**
☐	☐	**Grant Information Form**
☐	☐	**Grant Budget**
☐	☐	**Subcontract Budget**
☐	☐	**Contract/Agreement**
☐	☐	**Form 126 – Ethics Commission**
☐	☐	**Award Letter**
☐	☐	**Application**
☒	☐	**Public Correspondence**

OTHER

☒	☐	SFPUC Report – June 25, 2020
☒	☐	Reso. No. 484-19
☒	☐	COB Letter – Transmitting Reso. No 422-19 – October 15, 2020
☒	☐	SFPUC Presentation – September 19, 2019
☒	☐	Mayor Consolidated Response - September 16, 2019
☒	☐	SFPUC Response – September 11, 2019
☒	☐	Fire Commission Response – September 12, 2019
☒	☐	Civil Grand Jury Report – July 17, 2019
☒	☐	COB Letter – July 24, 2019
☒	☐	Response Matrices
☒	☐	Transmittal Letters

Prepared by: John Carroll **Date:** July 10, 2020
Prepared by: John Carroll **Date:** ____________

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

DATE:	June 25, 2020
TO:	Angela Calvillo, Clerk of the Board of Supervisors
FROM:	Harlan L. Kelly Jr., General Manager of the SFPUC HK Jeanine Nicholson, Chief of the Department, San Francisco Fire Department
SUBJECT:	Fiscal Year 2019-2020 Annual Emergency Firefighting Water System Report

---

Pursuant to Resolution No. 484-19, the San Francisco Public Utilities Commission and San Francisco Fire Department hereby provide the following report on the City's Emergency Firefighting Water System (EFWS). Resolution No. 484-19 urges the departments provide a consolidated annual report to the Board of Supervisors, "...on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan."

This report addresses the information requested in Resolution No. 484-19 and provides an update on the City's EFWS preparedness.

Program Background

The San Francisco EFWS is vital for protecting against the loss of life resulting from multi-alarm fires, as well as the loss of homes and businesses by providing an additional layer of fire protection. The system is used throughout the year for the suppression of multiple-alarm fires. The system delivers water at high pressure to the SFFD for firefighting purposes. The primary source of water is the SFPUC's Hetch Hetchy Regional Water System, which supplies water to one reservoir and two storage tanks. The water is subsequently supplied from the reservoirs and tanks into 135 miles of pipelines. The secondary source of water for the EFWS is the San Francisco Bay. There are two seawater pump stations that can supply seawater into the pipelines, as well as 35 suction connections along the northeastern waterfront, which allow fire engines to pump water from the Bay. Finally, two fireboats are available to supply seawater by pumping into any of the five manifolds connected to pipelines.

In 2010, 2014, and 2020, San Francisco voters approved three Earthquake Safety and Emergency Response (ESER) General Obligation Bonds, allowing

the City to make critical public safety investments and upgrades to emergency response facilities and infrastructure, including the EFWS.

With the passage of each ESER bond, the SFPUC, SFFD, Public Works, and the Office of Resilience and Capital Planning in the City Administrator's Office have made it a high priority to evaluate, plan, repair, upgrade, and expand EFWS infrastructure throughout San Francisco. In addition to ESER funded upgrades, large development projects in San Francisco have also installed EFWS infrastructure within and adjacent to project boundaries.

2020 Earthquake Safety and Emergency Response Bonds
In March of this year, San Francisco voters approved the 2020 Earthquake Safety and Emergency Response General Obligation Bond. That bond's programming included $153.5 million for the Emergency Firefighting Water System. That funding will be allocated to replace, extend and seismically upgrade system components to increase the ability to provide adequate water throughout the City for firefighting following a major earthquake and during multiple-alarm fires.

With the ESER funding, many upgrades will focus on improving EFWS capabilities in the City's western neighborhoods. The results and recommendations of the 2018 *Westside Emergency Firefighting Water System Options Analysis* planning study will help to inform the selection and design of specific projects to be funded through ESER 2020. Upon the completion of required environmental review, construction will proceed for selected projects.

Capital Projects: Fiscal Year 2019 – 2020
During Fiscal Year 2019-2020, ESER bond funds were utilized on a total of 10 capital projects, funding the installation of EFWS infrastructure and/or funding engineering and planning work in advance of installing the infrastructure. Please refer to Table 1 for more information.

Table 1: ESER Bond Funded EFWS Projects

Project	Status
Ashbury Bypass EFWS Pipeline	Completed
Terry Francois & Mariposa EFWS Pipeline	
Pump Station No. 1	
Irving Street EFWS Pipeline	
Pump Station No. 2 Upgrades	Under Construction
Terry Francois/Mission Rock/Warriors Way EFWS Pipeline	Construction will begin FY 2020-21
Clarendon Supply EFWS Pipeline	
19th Ave. EFWS Pipeline	
Potable Emergency Firefighting Water System	Planning and Design
Street Valve Motorization	Bidding

Technical Studies	Continuing
Administration	

Development Projects: Fiscal Year 2019 – 2020

Additionally, the SFPUC and SFFD coordinate with project sponsors of large development projects to ensure the installation of EFWS infrastructure within and adjacent to their respective projects. Please see Table 2 for development projects that installed or committed to install EFWS infrastructure this Fiscal Year.

Table 2: Development Projects: EFWS

Project	Status
Pier 70	Installed EFWS Infrastructure
HopeSF Sunnydale	
Potrero Power Station	EFWS Infrastructure included in Approved Development Agreement.
3333 California	
Balboa Reservoir	EFWS Infrastructure included in Development Agreement (Pending Approval)

Active Fires, Trainings, and Inspections: Fiscal Year 2019-2020

Additionally, the SFFD, SFPUC, and other agencies used EFWS infrastructure for trainings and active fires, performed routine inspections, and held joint meetings to discuss emergency response planning and project priorities. A summary of the SFFD's EFWS activities and partners for Fiscal Year 2019-2020 is provided in Table 3.

Table 3: Summary of SFFD EFWS Activity

Date	Participants	Activity
11/20/2019	**SFFD:** Fireboat St. Francis, E35, E08, E29, B03, D3, ADC Michael Cochrane, Deputy Chief Victor Wyrsch, Water Supply Officer Brent Stuckert, Division of Training Staff and members of the Bureau of Equipment. **SFPUC**: EFWS Superintendents, Utility Plumbers, Hydrant Gatemen, plumbers and members of the engineering Department	***Pier 90 salt-water inlet manifold drill*** The Fireboat St. Francis supplied salt water to a portion of the EFWS that had been isolated by the SFPUC to operate multiple high-pressure hydrants and a deck gun.
12/12/2019	**SFFD:** Deputy Chief Victor Wyrsch, Deputy Chief Jose Velo, Assistant Deputy Chief Dawn DeWitt, Assistant Chief	***Joint Agency Q&A and group discussion*** Improvements made to the EFWS

Date	Participants	Activity
	Brook Baker; Assistant Chief Robert Postel, Water Supply Officer Captain Brent Stuckert, Division of Training Staff and numerous Battalion Chiefs **<u>SFPUC</u>:** Rich Gonzales, Sean Duffy, Kevin O'Connor and Ryan Gabriel.	since the 1989 earthquake, strategies to further improve the system in its current configuration, agency response plans in the event of a large-scale disaster, and interagency drills that will be conducted on a quarterly basis.
02/29/2020	**<u>SFFD</u>:** 4th Alarm Fire at Toland St. / Evans St. **<u>SFPUC</u>**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations for this 4th Alarm Fire
3/03/2020	**<u>SFFD</u>:** E01, E35, B03, Water Supply Officer Captain Stuckert. **<u>SFPUC</u>:** Superintendent Rich Gonzales, Utility Plumbers and Hydrant Gatemen, Superintendent of Facilities Operations Brahman Conci	***Bay Bridge Pump Station and Standpipe drill*** This was a joint operation that required close coordination between the SFFD and the SFPUC and satisfied recommendation R10 of the 2019 Civil Grand Jury Report on the EFWS. The drill simulated a large-scale fire event on the west span of the Bay Bridge that would require more water than the 500 gallons that are carried by a single SFFD engine. This was the first time a drill of this nature has been performed and resulted in new standard operating procedures for disaster events on the Bay Bridge.
05/23/2020	**<u>SFFD:</u>** 4th Alarm Fire at Pier 45 **<u>SFPUC</u>**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations and to supply 5" hose provide by the hose tenders. The St. Francis Fireboat was put into operation and saved the historic Liberty Ship SS Jeremiah O'Brien from being destroyed by this 4th Alarm Fire.
10/26/2019 11/16/2019 12/21/2019 12/28/2019 01/25/2020	**<u>SFFD</u>:** Multiple engine companies and Battalion Chiefs	***5" Hose drills*** Regularly scheduled drill using 5" hose tenders and high pressure hydrants, ladder pipes and/or

Date	Participants	Activity
02/15/2020 05/04/2020 05/09/2020 05/16/2020		monitor nozzles/deck guns.
In Progress	**SFFD**: Water Supply Officer Captain Brent Stuckert **Rec & Park:** David Iribarne	***Joint Agency Discussion*** SFFD has contacted Rec and Parks asking them to consider adding more hydrants inside Golden Gate Park. The Urban Tree Canopy is now being taken into consideration in the latest Fire Following Earthquake models, and Golden Gate Park has a large amount of both surface and canopy fuel loads.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stucker **Port:** Shannon Alford	***Bay Dredging near salt-water inlet manifold.*** SFFD has been working with the SF Port to schedule dredging adjacent to the salt-water inlet manifold located on piers to ensure the St. Francis fireboat has adequate draft to perform pump operations through a complete 24-hour tidal cycle. SFFD has also requested the area near the Pump Station No. 1 inlet tunnel to be included in Port's dredging boundary. This inlet tunnel must be kept clear to allow the Pump Station to provide seawater to the EFWS.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stuckert, B07, 5" Hosetender **SFPUC:** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineers.	***SFFD-SFPUC Joint 5" Hose Drill*** Preparations have begun for a 5" Hose Tender Drill involving SFFD and SFPUC. SFPUC will assist with measuring exact pressures and water flow in the 5" lines to determine optimal placement of the 5" hose and engines for relay pumping operations. Relay pumping will be required to deliver water long distances and to the higher elevations of San Francisco. These preparations will increase the City's resilience by

Date	Participants	Activity
		mitigating the projected multiple post seismic ignitions. (This drill has been delayed due to the pandemic and will be conducted when normal operations can be resumed.)
In Progress	**<u>SFFD:</u>** Water Supply Officer Captain Brent Stuckert **<u>SFPUC:</u>** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***Bay Suction Connection Inspection Program*** Inspection and maintenance of the 35 Bay Suction Connections that are situated along the San Francisco Waterfront. These connections are used by SFFD engine companies to draft water from the Bay.
In Progress	**<u>SFFD</u>**: SFFD engine companies, Water Supply Officer Captain Stuckert. **<u>SFPUC:</u>** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***High Pressure Hydrant Inspection Program*** A High Pressure Hydrant Inspection program has been implemented. The SFFD and SFPUC are collectively inspecting and repairing the 1,644 High Pressure Hydrants in the City.

<u>Maintenance Projects: Fiscal Year 2019 – 2020</u>
Over the past year, the City Distribution Division (CDD) of the SFPUC completed numerous important maintenance activities to ensure that the EFWS is in a state of good repair. A summary of maintenance activities can be found in Table 4 of this report (page 7).

<u>Update on Memorandum of Understanding</u>
In 2015, the SFPUC and SFFD signed the *Memorandum of Understanding Regarding the Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression*. The SFPUC and SFFD are actively collaborating to update this Memorandum of Understanding to better detail and memorialize annual emergency response exercises, including simulated disaster and earthquake drills involving the EFWS. The timeline on this update has been delayed due to Coronavirus response; however, SFPUC and SFFD expect this update to be completed in 2020.

Table 4: Summary of Maintenance Activities

Facility Type	Facility	Activity Category	Type of Activity	Typical Frequency	Date Range: Jul 1, 2019 - June 15, 2020	
					Work Performed (Labor Hours)	Total Quantity of Maintenance Activities
Hydrants	Low Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect Condition Hydrant and Auxiliary Valve	296	Quantity inspected available upon request
			Condition Assessment*- College Hill Pressure Zone Hydrants and Valves	May 5, 2019 through July 16, 2019	556	932
			Hydrant Corrective Maintenance & Preventative Maintenance Activities	Ongoing	2,413	538
			Replace Caps & Chains and Service Hydrants	SFFD Requests	2,513	Quantity serviced and repaired available upon request
			Hit Hydrants	As Needed	483	57
			Preventative Maintenance	Ongoing by AWSS District	708	Quantity serviced available upon request
			Auxiliary Gate Valve Maintenance	Remove Debris and Uncover Aux. Gate Valves	515.5	98
		New Hydrants Installed	Replace/Install/Relocate Hydrants	As Needed	N/A	233

	High Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect and Document Condition of King Valves	1,793	Quantity inspected available upon request
			Hydrant Maintenance	Upon SFFD Request and Proactive Follow up Work from Inspections	2,966	508
			Rebuild High Pressure Hydrants and Scrap	Corrective - to support CM and Service Hydrant Program	2,015	N/A
		New Hydrants Installed	Install New High Pressure Hydrants	Redevelopment Projects	N/A	3
	Combined Low/High Pressure	Paint Hydrants	Paint Hydrant - Vandalism and Reported by SFFD	Ongoing	4,836	Labor based on Standing Work Orders
System Pipes		Replace and Renew Main Pipes	Main Pipe Leaks	As-needed	332	2
		Replace and Renew Hydrant Leads	Hydrant Leads	As-needed	860	5
Valves		Maintenance	Exercise Critical Valves	Once every 2 years	0*	Exercised 63 Critical Valves FY 18/19; To Exercise all valves FY 20/21
			Valve Vault Maintenance, Pump Flooded Vaults, Electrical and Mechanical Inspections	Corrective Maintenance based on FY 17/18 Survey	273	Location Details Available Upon Request
			System Valve Renewal	As-needed	783	6
			Altitude Valve Inspections	As-needed	15	-

			Inspect, Test, and Repair Valves/Actuators	As-needed	0	-
		Ames Valve Testing	Test Ames Valves	Ongoing	476	Quantity inspected available upon request
Pump Stations	PS1	Maintenance	Pump Testing and Backup Generator	Monthly	934	-
	PS2	Maintenance	Pump Testing and Emergency Backup Generator	BiMonthly	16	-
Tanks	Jones Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing and Backup Generator	Monthly	16	-
	Ashbury Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing	BiMonthly	4	-
Reservoir	Twin Peaks Reservoir	Maintenance	Inspect & Fill Twin Peaks Reservoir	As-needed	90	-
Cisterns		Maintenance & Inspections	Repair/Replace Cistern Handles, Fill Cisterns	As-needed	357	173
Suction Connections & Manifolds		Maintenance	Connection/Manifold Inspections and SFFD Dive Team Assistance	As-needed	0**	PM program scheduled for FY20/21
Manifold		Maintenance	Fire Boat Testing/Training	As-needed	185	-
Other Support		Maintenance/Operations Support	Instrumentation and Controls Calibration at all AWSS Facilities	Monthly	305	-
			Planning Support and Administration	Field Staff Planning and Supervisorial (Non-Management Labor)	2,057	-
			Landscaping & Pest Management	Quarterly	692.5	-

		Materials Management	As-needed (Includes only Non-Warehouse Staff Labor Charges)	767	-

Notes

* AWSS critical valves were exercised in FY18/19 and are scheduled to be exercised in FY20/21 (two-year cycle)

** Bay suction manifolds preventative maintenance program is scheduled for FY20/21

[Declaring a State of Urgency - Expanding the City's Emergency Firefighting Water System]

Resolution declaring a State of Urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

WHEREAS, The United States Geological Survey (USGS) estimates that the probability an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent; and

WHEREAS, In San Francisco, the most densely populated city in California, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings, and earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo, and San Francisco remains highly vulnerable to fire after an earthquake, as explained in a 2008 article for the *International Association for Fire Safety Science*; and

WHEREAS, The San Francisco Fire Department (SFFD), the San Francisco Public Utilities Commission (SFPUC), and this Board of Supervisors share a common goal of increasing the firefighting capabilities of all areas of San Francisco; and

WHEREAS, The EFWS is a high-pressure and volume fire suppression water system that can be utilized during large fires and is vital for protection against the loss of life, homes, and businesses from fire following a major earthquake and non-earthquake multiple-alarm fires; and

WHEREAS, The EFWS does not cover large parts of nor adequately protect Supervisorial Districts 1, 4, 7, and 11, roughly one-third of the City's developed area, which also have the fewest cisterns, and each fewer than ten miles of EFWS mains and fewer than 50 EFWS fire hydrants; and

WHEREAS, In June 2003, the 2002-2003 Civil Grand Jury recommended that the EFWS be extended "to serve all parts of the City," and 16 years later many neighborhoods still do not have new EFWS pipelines; and

WHEREAS, The SFPUC is developing a preliminary list of potential projects for various parts of the City where there is currently limited access to the EFWS, as well as other projects to reinforce or otherwise improve the existing EFWS; and

WHEREAS, The City does not have an agreed-upon timeline to fund and complete development of EFWS for all areas of the City, including neighborhoods that historically have not been as well protected as other areas of the City; and

WHEREAS, Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before some parts of the City have a high-pressure and volume, multi-sourced, seismically safe emergency firefighting water supply; and

WHEREAS, While the amount of money needed to implement EFWS citywide is estimated to be in the hundreds of millions of dollars, the potential loss of life and potential property damage could be far greater if an extremely large earthquake strikes San Francisco; and

WHEREAS, Based on the City's current pace of issuing ESER Bonds, it could take approximately 35 years or more to build out EFWS pipelines to serve all neighborhoods, unless the timing of the ESER Bond issuances are expedited or other sources of funding are identified; and

WHEREAS, SFPUC and SFFD are in the process of analyzing the best method for bringing a robust and resilient high-pressure and volume firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and are examining several options for the Westside, including potential development of a potable EFWS with over 14 miles of new EFWS pipelines and two new pump stations that could be supplied by four water sources; and

WHEREAS, To best utilize the existing EFWS and serve areas where the EFWS is lacking, it is critical that the SFFD obtain new updated Hose Tenders; and

WHEREAS, SFFD hose tenders are specialized apparatus designed for pumping and transporting large volumes of water from any source, are recognized worldwide for their ability to successfully move large amounts of water to a fire at high-pressures and volumes for firefighting, and are the ideal solution for areas with limited access to the EFWS because these vehicles can be dynamically deployed to any area of the City; and

WHEREAS, The SFFD currently has five Hose Tenders, three from 1973, one from 1987, and one from 1992, all of which are two-wheel drive, and do not have the capacity to draft or pump water; and

WHEREAS, In FY2019-2020 SFFD submitted a request for funding to purchase 20 Portable Water Supply System (PWSS) hose tenders, the Board of Supervisors and Mayor funded four new PWSS hose tenders, and the State of California funded one; and

WHEREAS, On October 8, 2019, Supervisor Gordon Mar requested the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board no later than December 31, 2020 (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term; and

WHEREAS, On October 1st, 2019, the San Francisco Board of Supervisors adopted a Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," on file with the Clerk of the Board of Supervisors in File No. 190786, which is hereby declared to be a part of this Resolution as if set forth fully herein; now, therefore, be it

RESOLVED, That the Board of Supervisors hereby declares a State of Urgency to rapidly expand the City's EFWS to protect all neighborhoods in the event of a major earthquake and fire, given that the vulnerability of the City poses a serious and urgent threat to the well-being of San Francisco and the safety of its inhabitants and environment; and be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC, SFFD and the Office of Resilience and Capital Planning to develop a comprehensive EFWS action plan, including funding sources, to install a high-pressure and volume, multi-sourced, seismically safe emergency water system to fight fires in the event of a major earthquake in all the parts of the City where it is lacking by June 30, 2034, to be submitted to the Board of Supervisors by December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC and SFFD to complete a study for adding an EFWS saltwater pump station on the Westside of San Francisco to be presented to the Board no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC to continue its efforts to complete more detailed analysis of emergency firefighting water needs by neighborhood and prepare a completed analysis by June 30, 2021; and, be it

FURTHER RESOLVED, That by June 30, 2022, the City should analyze whether to propose a separate bond for the development and implementation of EFWS projects for areas of the City with limited EFWS access as part of the City's regular capital planning process; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to prioritize funding for the purchase of new PWSS hose tenders, apparatus, and equipment to replace and expand SFFD's currently inadequate inventory within the next three Fiscal Years; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Department of Emergency Management, SFPUC, SFFD, and the Office of Resilience and Capital Planning to provide a consolidated annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan for EFWS by June 30 of each year, with the first report due June 30, 2020.

City and County of San Francisco
Tails
Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 191029 **Date Passed:** November 19, 2019

Resolution declaring a state of urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

November 08, 2019 Public Safety and Neighborhood Services Committee - RECOMMENDED

November 19, 2019 Board of Supervisors - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

November 19, 2019 Board of Supervisors - ADOPTED AS AMENDED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 191029

I hereby certify that the foregoing Resolution was ADOPTED AS AMENDED on 11/19/2019 by the Board of Supervisors of the City and County of San Francisco.

Angela Calvillo
Clerk of the Board

Unsigned
London N. Breed
Mayor

11/27/19
Date Approved

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Peggy Nevin

for Angela Calvillo
Clerk of the Board

11/27/19
Date

File No.
191029

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

October 15, 2019

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Department 206
San Francisco, CA 94102

RE: Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Dear Judge Wong:

The Board of Supervisors' Government Audit and Oversight Committee conducted a public hearing on September 19, 2019, to review the findings and recommendations of the 2018-2019 Civil Grand Jury report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Prior to the Committee meeting, the following City Departments submitted required responses to the Civil Grand Jury:

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;
- Fire Department:
  Received September 16, 2019;
- City Administrator:
  Received September 16, 2019; and
- Department of the Environment
  Received September 16, 2019.

Continues on next page

During the September 19, 2019 meeting, the Government Audit and Oversight Committee prepared a resolution responding to the requested findings and recommendations identified in the report. The response was prepared by Resolution No. 422-19, enacted on October 11, 2019.

By this message, the Office of the Clerk of the Board of Supervisors is transmitting Resolution No. 422-19 to your attention.

If you have any questions, please contact John Carroll, Government Audit and Oversight Committee Clerk at (415) 554-4445, or via email to john.carroll@sfgov.org.

Sincerely,

Alisa Somera

f Angela Calvillo
Clerk of the Board

c:
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Mark de la Rosa, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Ettore Leale, 2019-2020 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

City and County of San Francisco

Certified Copy

Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

190786 **[Board Response - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]**

Sponsor: Mar

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget. (Clerk of the Board)

10/1/2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

10/11/2019 Mayor - RETURNED UNSIGNED

STATE OF CALIFORNIA
CITY AND COUNTY OF SAN FRANCISCO

CLERK'S CERTIFICATE

I do hereby certify that the foregoing Resolution is a full, true, and correct copy of the original thereof on file in this office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the offical seal of the City and County of San Francisco.

October 15, 2019
Date

Angela Calvillo
Clerk of the Board

AMENDED IN COMMITTEE
9/19/19

FILE NO. 190786 RESOLUTION NO. 422-19

[Board Response - Civil Grand Jury Report - Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

WHEREAS, Under California Penal Code, Section 933 et seq., the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on the findings and recommendations contained in Civil Grand Jury Reports; and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), if a finding or recommendation of the Civil Grand Jury addresses budgetary or personnel matters of a county agency or a department headed by an elected officer, the agency or department head and the Board of Supervisors shall respond if requested by the Civil Grand Jury, but the response of the Board of Supervisors shall address only budgetary or personnel matters over which it has some decision making authority; and

WHEREAS, Under San Francisco Administrative Code, Section 2.10(a), the Board of Supervisors must conduct a public hearing by a committee to consider a final report of the findings and recommendations submitted, and notify the current foreperson and immediate past foreperson of the civil grand jury when such hearing is scheduled; and

WHEREAS, In accordance with San Francisco Administrative Code, Section 2.10(b), the Controller must report to the Board of Supervisors on the implementation of

recommendations that pertain to fiscal matters that were considered at a public hearing held by a Board of Supervisors Committee; and

WHEREAS, The 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" ("Report") is on file with the Clerk of the Board of Supervisors in File No. 190785, which is hereby declared to be a part of this Resolution as if set forth fully herein; and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors and the Budget and Legislative Analyst respond to Finding Nos. F6, and F11, as well as Recommendation No. R3, contained in the subject Report; and

WHEREAS, Finding No. F6 states: "Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply;" and

WHEREAS, Finding No. F11 states: "The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods;" and

WHEREAS, Recommendation No. R3 states: "The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020;" and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors respond to Finding Nos. F4, and F5, as well as Recommendation Nos. R1, R2, R4, R6, R7, and R8, contained in the subject Report; and

WHEREAS, Finding No. F4 states: "The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake;" and

WHEREAS, Finding No. F5 states: "A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City;" and

WHEREAS, Recommendation No. R1 states: "By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake;" and

WHEREAS, Recommendation No. R2 states: "The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034;" and

WHEREAS, Recommendation No. R4 states: "As an interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory;" and

WHEREAS, Recommendation No. R6 states: "The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations

from this study should be presented to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R7 states: "The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R8 states: "By no later than June 30, 2022, the Mayor and Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034;" and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on Finding Nos. F4, F5, F6, and F11, as well as Recommendation Nos. R1, R2, R3, R4, R6, R7, and R8 contained in the subject Report; now, therefore, be it

RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F4; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F5; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F6; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F11; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R1 has not been implemented but will be implemented no later than December 31, 2021,

and urges the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning to jointly present a detailed plan to the Board of Supervisors by no later than December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R2 has not been implemented but will be implemented by December 31, 2021, and urges the Departments to include in its detailed plan a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R3 has not been implemented but will be implemented in the future, and Supervisor Gordon Mar will issue a request for a Budget and Legislative Analyst report no later than December 31, 2019, and will direct the Budget and Legislative Analyst to issue the completed report no later than December 31, 2020; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R4 will not be implemented because while funding for five hose tenders was allocated for FY2019-2020 though both local and state-level actions, implementation of the recommendation in its entirety will depend on the appropriation actions of a future Mayor and Board of Supervisors; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R6 has not been implemented but will be implemented in the future, and urges the completion of a study for adding a salt-water pump stations to be presented to the Board of Supervisors by no later than June 30, 2021, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R7 has not been implemented but will be implemented in the future, and urges that a

completed analysis be presented to the Board of Supervisors by no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R8 has not been implemented but will be implemented in the future, and will analyze by June 30, 2022, in coordination with the Mayor, whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to cause the implementation of the accepted findings and recommendations through his/her department heads and through the development of the annual budget.

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 190786 **Date Passed:** October 01, 2019

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

September 19, 2019 Government Audit and Oversight Committee - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

September 19, 2019 Government Audit and Oversight Committee - RECOMMENDED AS AMENDED

October 01, 2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 190786

I hereby certify that the foregoing Resolution was ADOPTED on 10/1/2019 by the Board of Supervisors of the City and County of San Francisco.

for Angela Calvillo
Clerk of the Board

Unsigned
London N. Breed
Mayor

10/11/2019
Date Approved

File No. 190786

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Alisa Someia

for ~~Angela~~ Calvillo
Clerk of the Board

10/11/2019
Date

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. 19-0178

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, end push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthqueke (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the egency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco thet is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locetions ere entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenence/testing records, reguler maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.						

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

2018-2019 CIVIL GRAND JURY FINDINGS, RECOMMENDATIONS, AND RESPONSES TO FINDINGS AND RECOMMENDATIONS

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about en hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disester. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safa emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Frencisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 (for F4)	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnituda (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability end range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan end those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capitel Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be Implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir thet could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regionel Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implemant a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

1 DR. CARLTON B. GOODLETT PLACE, ROOM 200
SAN FRANCISCO, CALIFORNIA 94102-4681
TELEPHONE: (415) 554-6141

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be Implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be Implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be Implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

Civil Grand Jury 2018-19 Report:

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

John Scarpulla
SFPUC

San Francisco Water Power Sewer

ONESF Building Our Future

What is the EFWS?

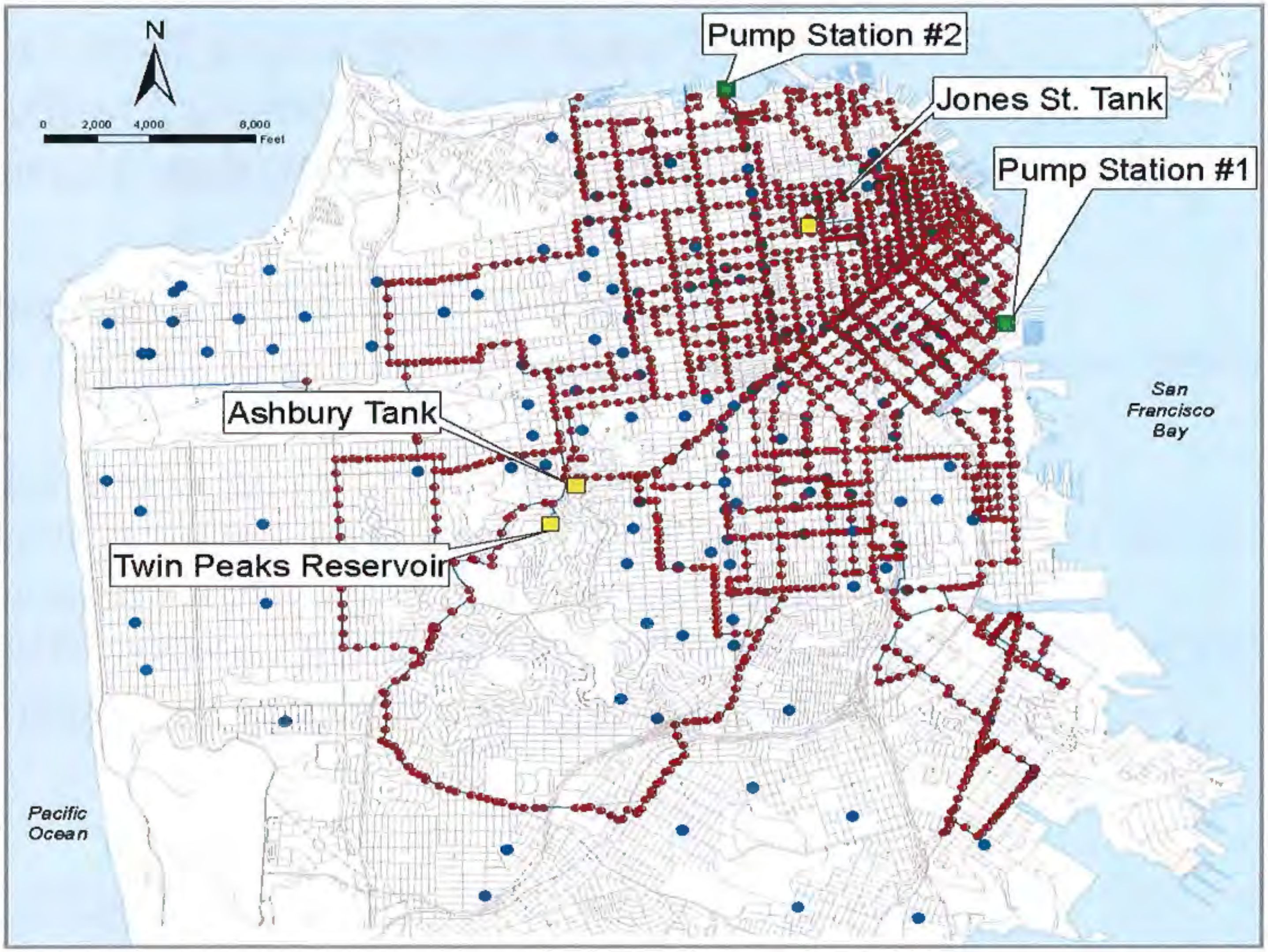
- Emergency Firefighting Water System (EFWS): A high-pressure fire-suppression water system built after 1906 earthquake
- Ownership transferred to SFPUC in 2010
- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works
- Hydraulic Modeling utilized to guide decision making.

Water Power Sewer

ONESF Building Our Future

Original EFWS Map

33 Seismically Reliable Valves Throughout System



ONESF
Building Our Future

Partnership

- Evaluation of EFWS when transferred to SFPUC:
  - Using modern seismic resilience capability analysis looking for vulnerabilities, leading to immediate and future projects
  - 47% system reliability for median flow of water needed by SFFD to fight fires after 7.8 earthquake
- Since 2010 - SFPUC, SFFD, and Public Works have been implementing projects to improve the EFWS.
- Projects completed utilizing Earthquake Safety and Emergency Response Bonds:
  - 2010 Bond: $102 million for EFWS capital projects
  - 2014 Bond: $54 million for EFWS capital projects

Water Power Sewer

ONESF
Building Our Future

Key ESER Projects Completed

- EFWS Reliability upgrades at three primary source supplies:
  - Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank
- Replaced engines and installed remote control capabilities for Seawater pump station #1
- Installation of 30 new cisterns:
  - 15 in the Sunset and Richmond districts
- Electronic Control Improvements
- 6 pipeline and tunnel projects

Key ESER Projects Underway

- Seawater pump station #2
- 19th Ave. Pipeline:
  - Bidding Feb 2020
- Ashbury Bypass Pipeline
- Clarendon Supply Pipeline
- Irving St. Pipeline
- Terry Francois Blvd. Pipeline:
  - Phase 1: completed
  - Phase 2: Bidding 2019

San Francisco Water Power Sewer

ONESF Building Our Future

Development Projects

- Large Development Projects install EFWS pipes within their development boundaries.
- SFFD & SFPUC negotiate with Developers for projects outside of the development boundaries.

- **Mission Rock**
- **Mission Bay**
- **Pier 70**
- **Potrero Powerplant**
- **Potrero Hope SF**
- **Sunnydale Hope SF**
- **Park Merced**
- **Candlestick**
- **Hunters Point/Shipyard**
- **Executive Park**
- **Visitation Valley**
- **India Basin**

San Francisco Water Power Sewer
ONESF Building Our Future

Preliminary List of Potential Projects

- Developed a preliminary list of potential projects that SFPUC and SFFD continue to develop and analyze

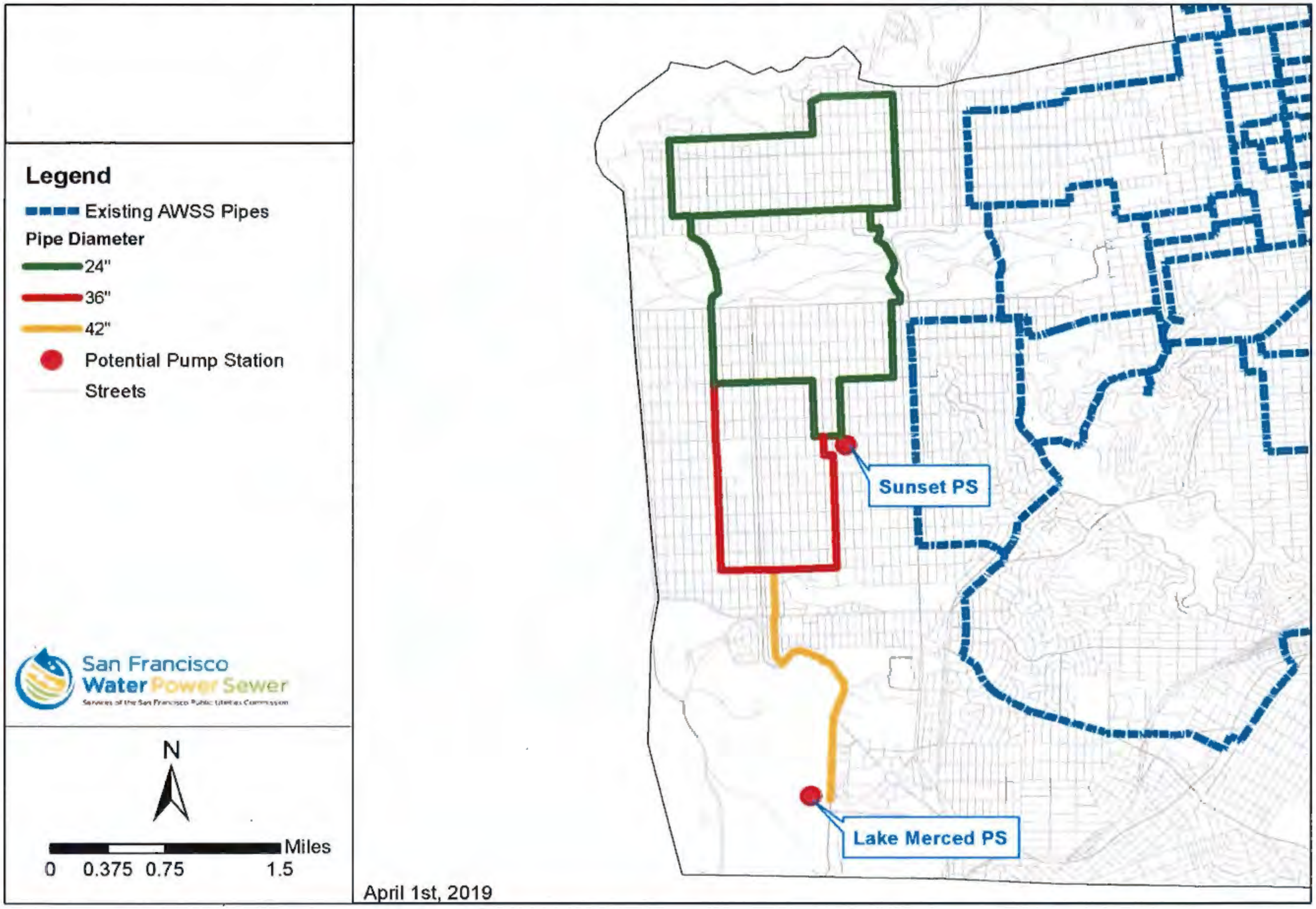
- Preliminary projects range in scope:
  - Pipeline projects
  - New water sources
  - Infirm area projects

- Citywide with a focus in areas that have limited access to the EFWS

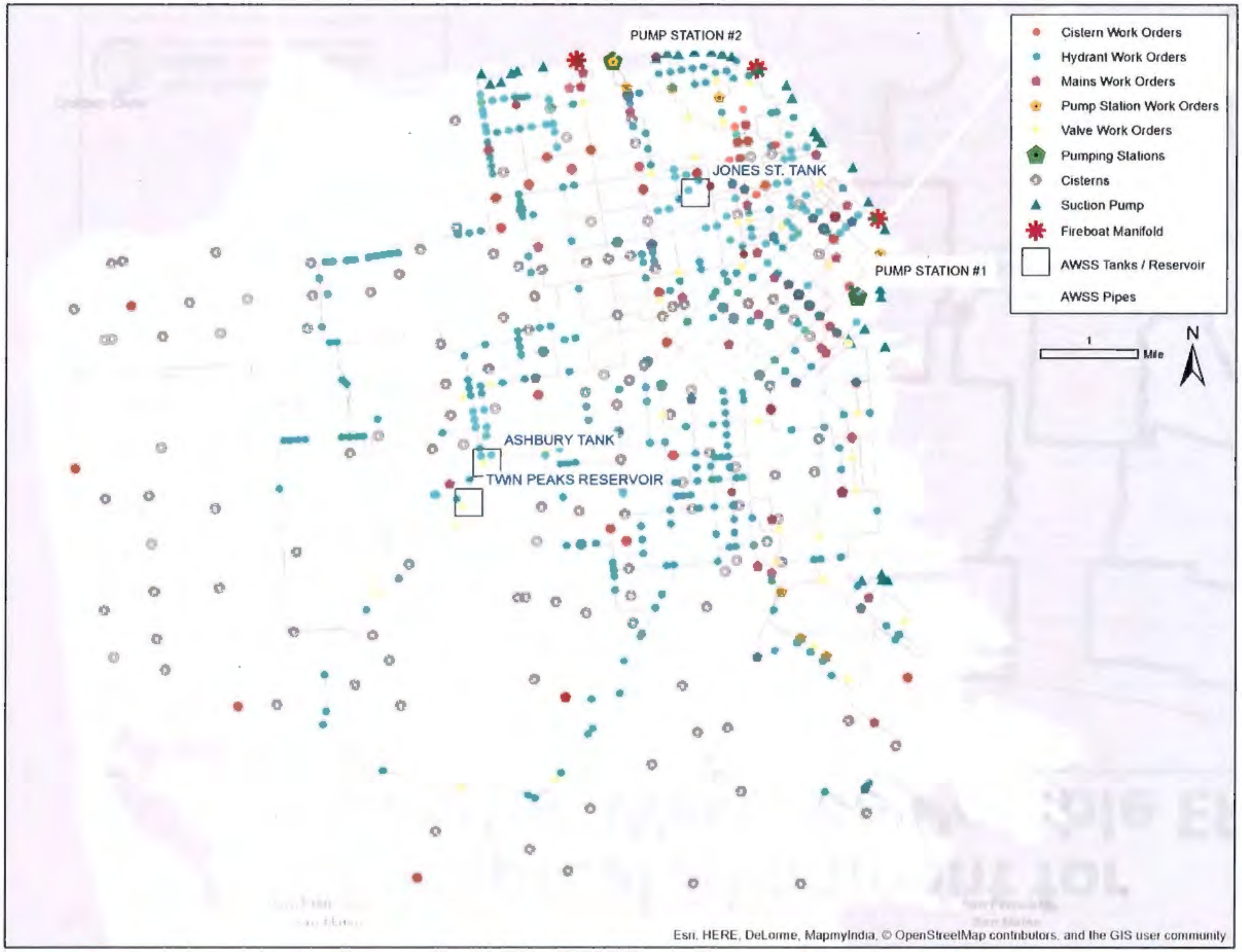
San Francisco Water Power Sewer

ONESF Building Our Future

Conceptual Alignment for Potential Westside Potable EFWS



Maintenance Activities



Water Power Sewer

ONESF
Building Our Future

Moving Forward

- Continue to implement EFWS projects using remaining 2014 ESER Bonds: ***estimated completion end of 2021***
- Continue to perform routine and high-quality maintenance on the EFWS to ensure it is in good working order: ***ongoing***
- 5 Hose Tenders in FY19-20 Budget (4 in City Budget, 1 from State)
- Continue to conduct regular emergency response trainings with all applicable City agencies, while also working collaboratively to enhance the scope and frequency of trainings: ***ongoing***
- Memorialize a detailed roadmap for annual emergency response exercises in SFFD-SFPUC Memorandum of Understanding: ***6/30/2020***

San Francisco Water Power Sewer

ONESF Building Our Future

Moving Forward Cont'd.

- SFPUC and SFFD complete seawater pump station study: ***6/30/2021***

- SFPUC to continue efforts to complete more detailed analysis of emergency firefighting water needs within neighborhoods: ***6/30/2021***

- Develop a robust and thorough plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 7.8 earthquake: ***12/31/2021***

- Quarterly presentations to SFPUC Citizen Advisory Committee and increased community meetings: ***ongoing***

Water
Power
Sewer

ONESF
Building Our Future

EFWS in the Capital Plan

- Recent Funding
  - ESER 2010: $102.4 million
  - ESER 2014: $54.1 million
- FY2020-29 Capital Plan
  - ESER 2020: $153.5 million
  - SFPUC Funds
  - Future ESER Funds

San Francisco Water Power Sewer

ONESF Building Our Future

Thank you

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

DATE: September 16, 2019

TO: Members of the Board of Supervisors

FROM: Angela Calvillo, Clerk of the Board

SUBJECT: 2018-2019 Civil Grand Jury report, entitled
"Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

We are in receipt of the following required responses to the San Francisco Civil Grand Jury report released July 17, 2019, entitled: "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System." Pursuant to California Penal Code, Sections 933 and 933.05, named City Departments shall respond to the report within 60 days of receipt, or no later than September 15, 2019.

For each finding the Department response shall:

1) agree with the finding; or
2) disagree with it, wholly or partially, and explain why.

As to each recommendation the Department shall report that:

1) the recommendation has been implemented, with a summary explanation; or
2) the recommendation has not been implemented but will be within a set timeframe as provided; or
3) the recommendation requires further analysis. The officer or agency head must define what additional study is needed. The Grand Jury expects a progress report within six months; or
4) the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

The Civil Grand Jury Report identified the following City Departments to submit responses (attached):

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;

Continues on next page

- Fire Department:
  Received September 16, 2019; and
- City Administrator:
  Received September 16, 2019.
- Department of the Environment
  Received September 16, 2019.

These departmental responses are being provided for your information, as received, and may not conform to the parameters stated in California Penal Code, Section 933.05 et seq. The Government Audit and Oversight Committee will consider the subject report, along with the responses, at a hearing on September 19, 2019.

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	San Francisco Public Utilities Commission Response (by the Commission President) to the 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:14:02 AM
Attachments:	President Caen Letter to CGJ.pdf

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Wednesday, September 11, 2019 11:11 AM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

From: Hood, Donna
Sent: Wednesday, September 11, 2019 11:10:54 AM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Kelly Jr, Harlan; Breed, London (MYR)
Subject: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

Good Morning,

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*.

Thank you,

Donna Hood
Commission Secretary
San Francisco Water, Power and Sewer/Services of the San Francisco Public Utilities Commission
525 Golden Gate Ave., 13th Floor
San Francisco, CA 94102
415-554-0761 (direct)
http://sfwater.org/

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **19-0178**

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.					

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	Fire Commission Response to 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:03:24 AM
Attachments:	Copy of Fire Commission_Nakajo_AWSS Matrix of Findings and Recommendations Response 190904.xlsx

---

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Thursday, September 12, 2019 1:24 PM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Civil Grand Jury Report

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 1:24:22 PM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Rasha Harvey; Steve Nakajo (sknakajo@yahoo.com); Nicholson, Jeanine (FIR)
Subject: RE: Civil Grand Jury Report

⚠ **WARNING: This email was generated from an external source. You should only open files from a trustworthy source.**

Here's the correct document.

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 11:45 AM
To: CGrandJury@sftc.org
Cc: Rasha Harvey <r.harvey@sfcgj.org>; Steve Nakajo (sknakajo@yahoo.com) <sknakajo@yahoo.com>; Nicholson, Jeanine (FIR) <jeanine.nicholson@sfgov.org>
Subject: Civil Grand Jury Report

Dear Honorable Garrett L. Wong,

Please see attachments.   I will also send by U.S. Mail.

Sincerely,

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

City and County of San Francisco

2018-2019 Civil Grand Jury

MEMORANDUM

TO: Mayor and Members of the Board of Supervisors

CC: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Anatolia Lubos, Grand Jury Administrative Analyst

DATE: July 18, 2019

SUBJECT: Civil Grand Jury Report, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

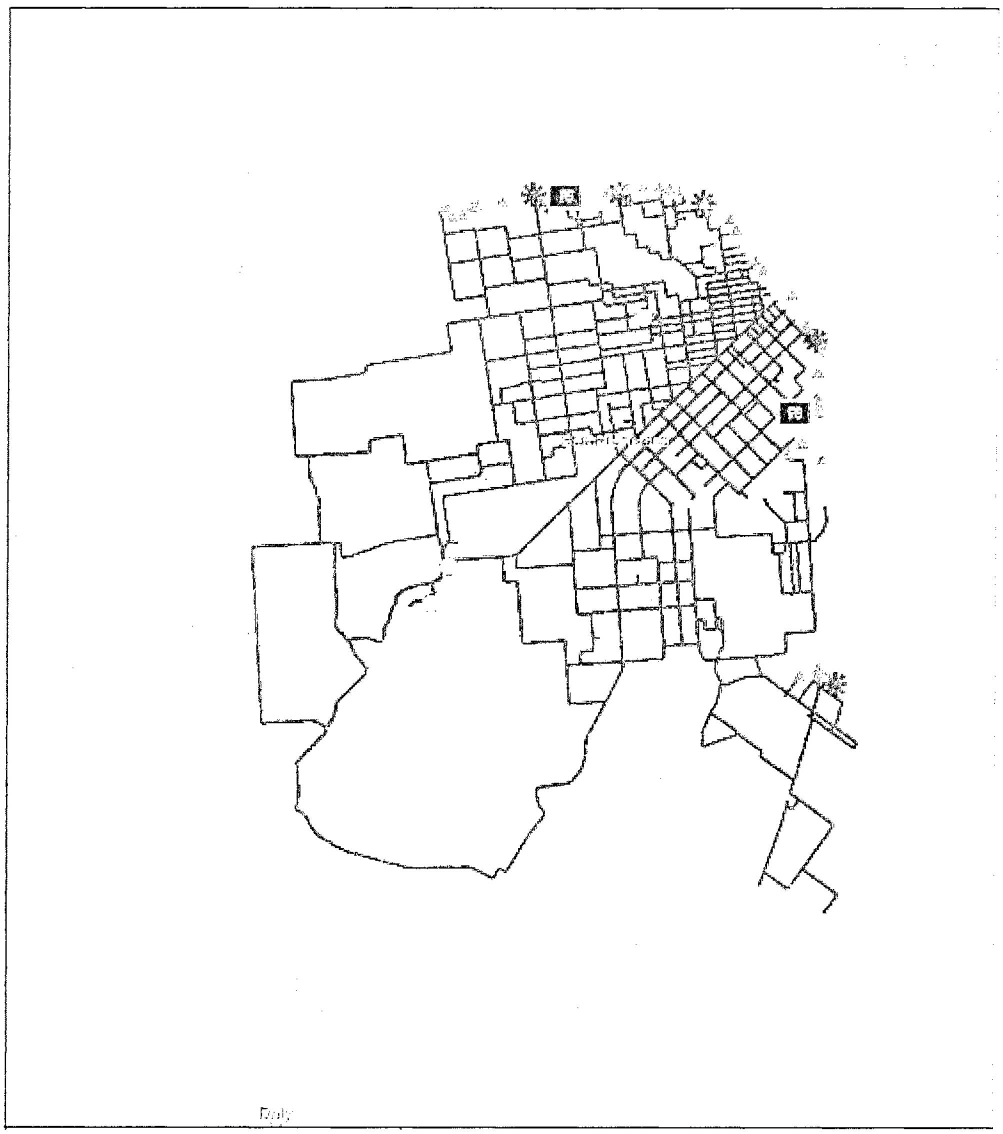
The previous version of the aforementioned Civil Grand Jury report as received and distributed on Monday, July 15, 2019 was incomplete and omitted Appendices F to R (inclusive).

Enclosed is the complete report.

400 McAllister Street, Room 008, San Francisco, CA 94102
Phone: 415-551-3635

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR HIGH-PRESSURE EMERGENCY FIREFIGHTING WATER SYSTEM



CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

THE CIVIL GRAND JURY AND ITS OPERATIONS

California state law requires that all 58 counties impanel a Grand Jury to serve during each fiscal year. *California Penal Code Section 905; California Constitution, Article I, Section 23*

The Civil Grand Jury investigates and reports on one or more aspects of the County's departments, operations, or functions. *California Penal Code Sections 925, 933(a)*

Reports of the Civil Grand Jury do not identify individuals interviewed by name. *California Penal Code Section 929*

The Civil Grand Jury issues reports with findings and recommendations resulting from its investigations to the Presiding Judge of the Superior Court. *California Penal Code Section 933(a)*

Each published report includes a list of those elected officials or departments that are required to respond to the Presiding Judge of the Superior Court within 60 or 90 days as specified. *California Penal Code Section 933*

California Penal Code Section 933.05 is very specific with respect to the content of the required responses. Under Section 933.05(a), for each finding, the response must:

1) Agree with the finding, or
2) Disagree with it, wholly or partially, and explain why.

Similarly, under Penal Code Section 933.05(b), for each recommendation, the responding party must report that:

1) The recommendation has been implemented, with a summary of the implemented action; or
2) The recommendation has not been implemented but will be within a set timeframe; or
3) The recommendation requires further analysis, with an explanation of what additional study is needed, and the timeframe for conducting that additional study and the preparation of suitable material for discussion. This timeframe may not exceed six months from the date of publication of the Civil Grand Jury's report; or
4) The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Any San Francisco resident who is a US citizen and is interested in volunteering to serve on the Civil Grand Jury for the City and County of San Francisco is urged to apply. Additional information about the San Francisco Civil Grand Jury, including past reports, can be found online at http://civilgrandjury.sfgov.org/index.html .

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

MEMBERSHIP ROSTER

RASHA HARVEY (Foreperson)

JANET ANDREWS HOWES (Parliamentarian)

LINDA BADGER

ANDREW BENJAMIN

GORDON CRESPO

KRISTINE EQUIHUA (Technology Secretary)

STEPHEN GARBER

JONATHAN HILL

LEONARD KULLY (Correspondence Secretary)

WILLIAM LEE (Foreperson Pro Tem)

FRANK NETTLETON

NONA RUSSELL

RANDALL SMITH (Recording Secretary)

KAAREN STRAUCH BROWN

RUSH STURGES

MARTHA SUTHERLIN

JASON TAM

MICHAEL WIXTED

EXECUTIVE SUMMARY

San Francisco is one of the most vulnerable cities in the world, and certainly in the United States, to the risk of fire following an earthquake. In 1906, the City suffered tremendous destruction and devastation from the fires that followed a major earthquake. Over 3,000 people died and approximately 28,000 buildings were destroyed. In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage. We know the question is when, not if, another major earthquake will strike San Francisco and ignite numerous fires.

The Civil Grand Jury believes it is essential that we take prompt and aggressive action to expand and enhance our defenses against the inevitable fires following an earthquake before it is too late. All parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – deserve to be well protected against this catastrophic risk.

Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system (MWSS) -- that provides excellent firefighting protection to parts of the City. However, large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS and are not nearly as well protected.

Plans to develop a seismically safe high-pressure AWSS for the western portions of our City are now moving forward. But even though City leaders have known about this issue for decades, the City still does not have concrete plans or a timeline to provide a more robust emergency firefighting water supply for all parts of the City that need one.

In 2014, the U.S. Geological Survey (USGS) estimated there is a 72 percent chance of one or more magnitude 6.7 or greater earthquakes striking the Bay Area between 2014 and 2043. Earlier this year Mayor London Breed announced that planning for such a disaster is a priority. But at our current pace and funding levels, expansion of a high-pressure AWSS to currently unserved parts of the City will not be completed for another thirty-five (35) years or more–well after the USGS predicts we will be struck by one or more major earthquakes.

The Civil Grand Jury makes the following recommendations, among others which are more fully discussed herein:

- The City should be prepared to fight fires in all parts of the City in the event of a repeat of a 1906 size earthquake;
- The City should aggressively develop a high-pressure, multi-sourced, seismically safe emergency water supply for those parts of the City that don't currently have one, with a target completion date of no later than 2034;
- As an interim measure, the City should immediately replace and expand its inventory of Portable Water Supply System (PWSS) hose tenders, which are comparatively cheap, can be acquired much more quickly than the high-pressure AWSS, and were essential in fighting the 1989 Loma Prieta fire, but are now past their useful life;
- The new PWSS hose tenders should be strategically placed in those areas of the City that do not have a high-pressure, multi-sourced, seismically safe emergency water supply.

TABLE OF CONTENTS

List of Figures **Page No.**

List of Tables **Page No.**

BACKGROUND AND PROBLEM STATEMENT

No one knows when the next large earthquake is coming. But it is coming.

A. Fire Following Earthquake Is a Major Risk to The City

"San Francisco will sustain major damage from fires following future earthquakes, in addition to the damage caused by shaking."[1] As explained in a 2010 report prepared for the City,

> In San Francisco, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo.[2]

A main reason the 1906 fire was so devastating is that the earthquake destroyed much of the water system.[3]

Fires following earthquakes remain a major threat today. In 1994, approximately 110 fires were ignited after the Northridge earthquake in Los Angeles County, even though it was "only" a 6.7-magnitude earthquake.[4] In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage.[5] In Kobe "broken water

---

[1] Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010) ("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[2] *Id.*; footnote omitted.

[3] See Scawthorn, C., O'Rourke, T. D. & Blackburn, F., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*, Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; see also Scawthorn, C., Water Supply In Regard to Fire Following Earthquake, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 5.

[4] See discussion in Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 7; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 12-17.

[5] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 17-19; ATC, 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

mains left the fire department helpless, and fires destroyed more than 7,000 buildings."[6] A magnitude 7.9 earthquake would be an estimated 10 times larger than a magnitude 6.9 earthquake, and would release approximately 31 times more energy.[7]

San Francisco is by far the most densely populated large city in California and is the second most densely populated large city in the country.[8] With mostly wood construction in many areas, this dense City remains at significant risk.[9]

B. AWSS Background and Current Status

After the 1906 earthquake and its devastating fires, the City built an independent emergency water supply for firefighting, known as the AWSS.[10]

The AWSS is a separate, non-potable emergency firefighting water supply system that at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations.[11] Applying a "belt

---

[6] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[7] See the United States Geological Survey's "How Much Bigger ....?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can compare the relative size and strength of different magnitude earthquakes.

[8] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 6.

[9] Ibid.

[10] See generally SFPUC, Frequently Asked Questions–Fire Suppression Water Systems, dated November 2017 "SFPUC 2017 FAQ", https://sfwater.org/modules/showdocument.aspx?documentid=11507 attached as Appendix N; see also Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf

[11] AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report), February2014 ("CS-199"), at p. 7, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; SFPUC Fact Sheet, dated Summer 2012, located at https://www.sfwater.org/modules/showdocument.aspx?documentid=2501 and printed March 6, 2019. The online Fact Sheet is outdated, as the City has added approximately 30 more cisterns through the 2010 and 2014 ESER bonds. The SFFD also has three large capacity fireboats berthed at Pier 22 ½ and an additional, smaller fireboat berthed at the San Francisco Marina Yacht Harbor.

People sometimes confuse Emergency Firefighting Water System (EFWS) and AWSS, or use them interchangeably. EFWS is the broader concept, including all emergency sources of water and the means for delivering them. AWSS is sometimes described as including cisterns, and other times not. Compare CS-199, at p. 7, ("AWSS is a water supply system consisting of pipelines, cisterns, reservoir, storage tanks, and salt-water pump stations.") https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 with AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report, January 5, 2018 ("2018 Westside Options Analysis"), at pp. 10-13, 20 (differentiating between EFWS and AWSS, and discussing cisterns as a supplement to but not part of AWSS), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

and suspenders" approach, if the City's MWSS mains break leaving low-pressure hydrants useless, firefighters will have access to other sources of water, including the Twin Peaks Reservoir and the Bay. Unlike the MWSS, AWSS pipelines were designed to withstand movement from an earthquake.[12]

The AWSS is "remarkably well designed to furnish large amounts of water for firefighting purposes under normal conditions and contains many special features to increase reliability in the event of an earthquake."[13] The AWSS is "designed to provide water at higher pressures than the potable water system, allowing firefighters to use water from the AWSS hydrants without requiring a fire engine."[14]

Another of the key features of the AWSS is its redundancy. The HP AWSS was designed with both a redundant water supply and a gridded main system.[15] This feature provides a more reliable emergency water supply system, allowing potential pipe breaks to be bypassed.[16] As succinctly stated by an outside expert, "the AWSS achieves high reliability by having multiple sources, a highly redundant network and special piping and valves."[17]

The AWSS was originally built over 100 years ago, at a time when the northeast portion of the City contained both the central business district and the majority of the City's population.[18] As a result, the multi-sourced, HP AWSS pipeline network primarily covers just the northeastern part of the City.[19]

The City has been considering expanding the HP AWSS for decades. For example the Analysis by the Ballot Simplification Committee of 1986's Proposition A, Fire Protection Bonds, specifically noted that parts of the City were not served by the HP AWSS:

This report will use EFWS as the broader concept, and will generally use AWSS to refer to the HP AWSS (the 135 miles of pipelines and associated facilities but not including cisterns), although we will not change quotes. This distinction is important, as there are cisterns in the southern and western portions of the City, but not the HP AWSS.

[12] CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[13] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf,, at p. 80; see also Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp.12-15.

[14] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[15] *Id.*, at p. 37.

[16] Ibid.

[17] C. Scawthorn, January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis" "Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 .

[18] See SFPUC 2017 FAQ, Question 2, at https://sfwater.org/modules/showdocument.aspx?documentid=11507 , a copy of which is attached as Appendix N.

[19] *Id.*

> THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.[20]

In June 2003, the 2002-2003 Civil Grand Jury recommended that the HP AWSS be extended "to serve all parts of the City."[21] Yet three decades after the 1986 bond and 16 years after the prior Civil Grand Jury report, many neighborhoods still do not have HP AWSS pipelines.[22] Plans are moving forward to fund a new HP AWSS using potable water on the west side through an upcoming Earthquake Safety and Emergency Response Bond (ESER) issuance, but at the City's current pace it will take approximately 35 years or more to build out a HP AWSS pipeline system that serves all neighborhoods, including the southern portions of the City.[23] The City does not have a plan with a firm timeline for completion of this work or firm plans to fund all the work that needs to be done.

C. Problem Statement

Certain parts of the City, such as the northeast quadrant, are well protected against the risk of fires following an earthquake. These well-protected areas have a multi-sourced, redundant, Emergency Firefighting Water System (EFWS), including the HP AWSS. Unfortunately, other parts of the City are protected only by the low-pressure MWSS and by cisterns, which are not

[20] The 1986 Ballot Simplification Committee Analysis explained the proposal for Proposition A as paying for improvements including extending the high-pressure system and installing a high-pressure pump station at Lake Merced. Proposition A passed, but large areas of the City still do not have the protection of the independent high-pressure water system, and Lake Merced still does not have a high-pressure pump station. A copy of the Analysis by the Ballot Simplification Committee of the 1986 Proposition A is attached as Appendix L.

[21] 2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf, at p. 2.

[22] Neighborhoods currently without HP AWSS hydrants include Bayview Heights, Crocker Amazon, Excelsior, Ingleside, Merced Manor/Parkside, Mission Terrace, Oceanview, Outer Mission, Outer Richmond, Outer Sunset, Portola, Sea Cliff, Stonestown, and Sunnyside. A map showing the current layout of HP AWSS pipelines is on the cover and is attached as Appendix I.

[23] March 4, 2019 and March 11, 2019 SFPUC presentations and accompanying materials provided to the Emergency Firefighting Water System Management Oversight Committee. The amount of funding potentially available through the 2020 ESER bond and through water rates has been increased since the March 2019 Emergency Firefighting Water System Management Oversight Committee meetings. Thus, it *may* now be somewhat less than the 35 years presented in March. It has been difficult to tie down the City's "pace of funding" given there are no firm long term plans and the amount of funding available through an ESER bond can and does change. Although 35 years may be off somewhat, it remains the best (indeed only) current articulation of pace of funding and a timeline provided to the Civil Grand Jury.

nearly as reliable for fighting fires following a major earthquake and, unlike the HP AWSS, need fire engine support to effectively deliver water to a fire.[24]

The problem addressed in this report is how to ensure that all parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – are well protected from fires following earthquakes before it is too late.

METHODOLOGY

Members of the Civil Grand Jury conducted interviews with representatives of:

- The San Francisco Public Utilities Commission
- The San Francisco Fire Department
- The San Francisco Department of Public Works
- The San Francisco Office of Resilience and Capital Planning
- The San Francisco Department of the Environment
- The San Francisco Fire Commission
- The Board of Supervisors

Members of the Civil Grand Jury also conducted interviews with:

- Retired members of the San Francisco Fire Department
- A retired fire chief from a local jurisdiction
- Technical experts in the fields of engineering, wildfires, and water supply for fighting fires after earthquakes
- Concerned community members

Members of the Civil Grand Jury reviewed numerous planning and engineering reports specifically focusing on the AWSS or the PWSS, listed in Appendix D.

Members of the Civil Grand Jury also reviewed the relevant parts of articles, publications and reports regarding fires following earthquakes and related issues. These more general sources, some of which discuss the AWSS or PWSS but are not solely focused on them, are listed in Appendix E. [25]

---

[24] See discussion of expected problems of relying on a municipal water supply system in Section D of the Discussion, at pp. 18-20.

[25] Several of these publications are technical papers, and the Civil Grand Jury is comprised of lay citizens. When we cite or refer to technical papers it is generally for the conclusions or other non-technical information; we do not purport to be knowledgeable regarding the intricacies of fire spread models or the like.

DISCUSSION

Succinctly stated, "water supply is critical to firefighting."[26] Without a reliable water supply, the San Francisco Fire Department (SFFD) cannot be realistically expected to fight fires following a major disaster such as an earthquake.

A. San Francisco is Highly Vulnerable to Fires Following a Major Earthquake

San Francisco is highly vulnerable to fire after an earthquake, more than any other city in the country.

As explained in a 2008 article for the International Association for Fire Safety Science,

> Densely built environments are highly vulnerable to disasters. Common problems include: (a) narrow streets enabling fire to spread easily from one building to another; (b) streets cluttered with collapsed buildings in an earthquake restricting fire engine access; (c) shortage of open spaces which function as fire breaks or evacuation sites; (d) older and less robust wooden houses that easily collapse and burn in an earthquake ....[27]

San Francisco has significantly higher population density than any other county in California, as shown in Figure 1 on the next page: [28]

---

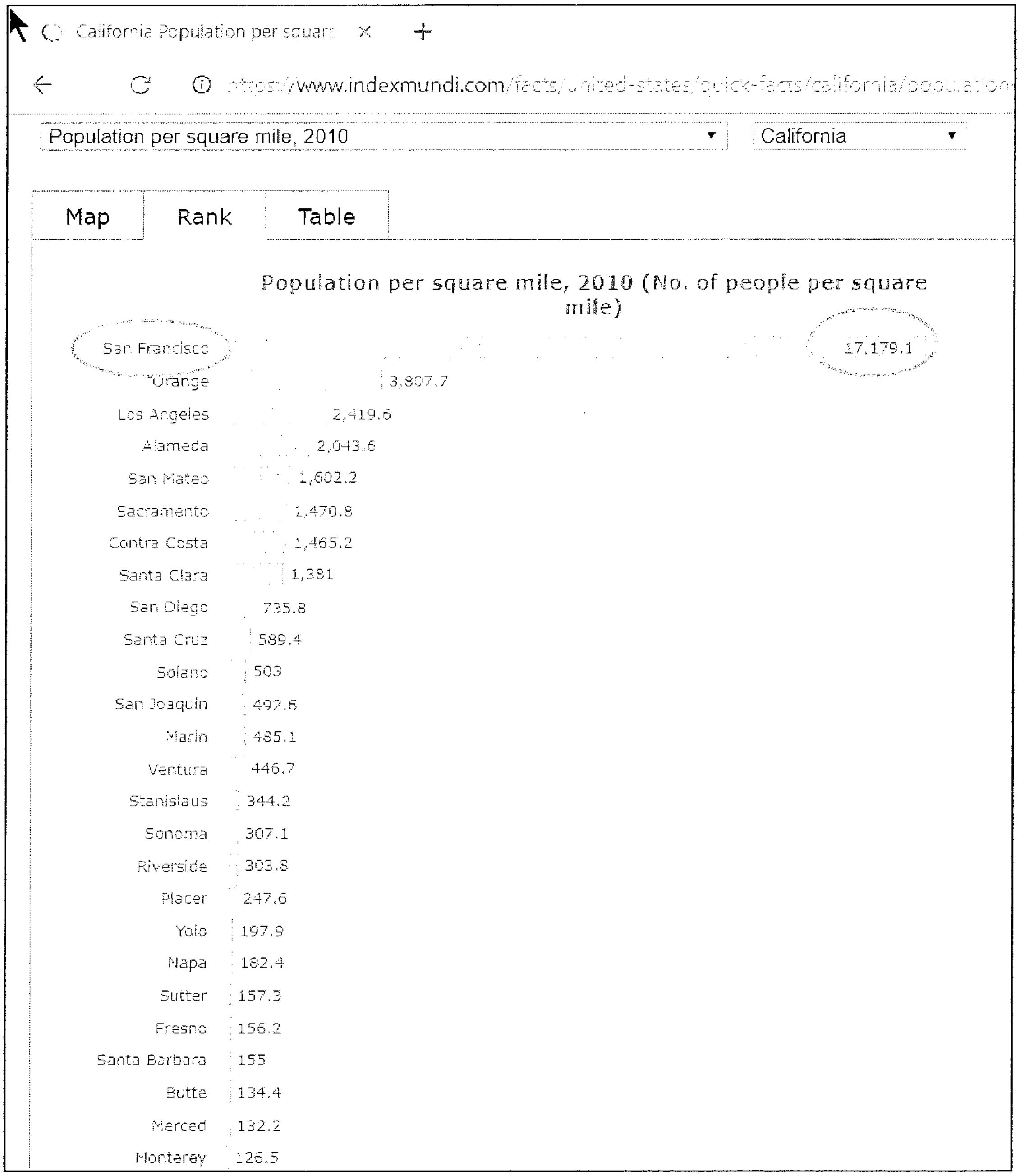
[26] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 12.

[27] Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf. at pp. 267-268 (parenthetical reference omitted). San Francisco does have streets that operate as fire breaks: Market St., Van Ness Ave., Geary St. (west of Gough), Dolores St., Mission St, 19th Avenue, Park Presidio Blvd., Alemany Blvd., and Third Street.

[28] See https://www.indexmundi.com/facts/united-states/quick-facts/california/population-density#chart .

Figure 1

Population Density By County



Similarly, based on 2016 data, San Francisco is the eighth densest city in the country with a population above 50,000, and other than New York City is the densest city with a population above 100,000:[29] See Figure 2, below.

Figure 2

Population Density by City

https://www.governing.com/gov-data/population-density-land-area-cities-map.html

Maps & Data - Geography - U.S. Census Bureau

- Passaic, N.J.: 22,424 persons/sq. mile

The following table lists population densities for U.S. cities with populations of at least 50,000 as of 2016:

Search:

City	Population Density (Persons/Square Mile)	2016 Population	Land Area (Square Miles)
Union City, New Jersey	54,138	69,296	1
West New York, New Jersey	52,815	53,343	1
Hoboken, New Jersey	42,484	54,379	1
New York, New York	28,211	8,537,673	303
Passaic, New Jersey	22,424	70,635	3
Somerville, Massachusetts	19,738	81,322	4
Huntington Park, California	19,561	58,879	3
San Francisco, California	18,581	870,887	47
Jersey City, New Jersey	17,860	264,152	15
Paterson, New Jersey	17,438	147,000	8
Cambridge, Massachusetts	17,316	110,651	6
East Orange, New Jersey	16,528	64,789	4

San Francisco also has many narrow streets, and buildings that will almost certainly collapse in an earthquake and obstruct many streets, blocking traffic including fire engines. We also have a heavy concentration of older, wooden homes that are densely concentrated and highly flammable.[30]

[29] https://www.governing.com/gov-data/population-density-land-area-cities-map.html.

[30] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

This is not just the Civil Grand Jury's perspective. Many experts, and numerous witnesses interviewed by the Civil Grand Jury, have opined that San Francisco faces "the most serious conflagration risk" and "will sustain major damage from fires following future earthquakes…."[31]

In July 2010, SPA Risk LLC (Dr. Charles Scawthorn, principal) prepared a report entitled, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, for the Applied Technology Council (ATC) on behalf of the City's Department of Building Inspection.[32] The report concluded that San Francisco is at "significant risk" due to fire following earthquake, and that the SFFD's fire engines[33] "will almost certainly not be able to respond to all post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for a magnitude 7.9 San Andreas event."[34]

A key table in that 2010 report is copied below:

Table 1

Bounds for Losses to Buildings Due to Fire Following Earthquake[35]

	25% - 75% Confidence Range		
	Ignitions	Loss $ billions	Total Burnt Building Floor Area Mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

---

31 See, e.g., Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf, at p. iii ("Scawthorn 1987"); ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at pp. vi, 25-29.

32 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf.

33 SFFD now has 44 frontline fire engines, and 19 relief engines, according to information provided by the SFFD. At the time of the 2010 report, the City apparently had 42 frontline engines.

34 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2. A copy of the Abstract (or summary) of that report is attached as Appendix K.

35 Ibid. These estimates already take into account the AWSS system as it existed in 2010 (i.e., prior to the addition of more cisterns and other work performed under the 2010 and 2014 ESER bonds). The damage estimates do not include business interruption losses, loss of tourism or loss of property tax revenues.

As explained in that report, there is significant uncertainty regarding how many fires might be ignited following an earthquake, and the extent of damage they are likely to cause. One of the key variables is completely outside the City's control: wind. In 1989, the City was extremely lucky that there was no wind.[36] Indeed, "stronger wind conditions would have resulted in much greater fire spread in the Marina…."[37]

According to the 2010 report, there is a 25% chance that fires and damages could fall below the ranges in Table 1 on the preceding page, and an equal likelihood that they could exceed the ranges in that table.[38] Earlier this year (2019) the San Francisco Public Utilities Commission (SFPUC) engaged Dr. Scawthorn to update his analysis, but that update will not be completed until after this report has been issued. However, the key is not the precise numbers but "their overall magnitude."[39] Indeed, given the escalation in Bay Area home values over the last decade, one can only assume that the dollar loss estimates will increase substantially.

B. The USGS Warns the San Francisco Bay Area Has a High Likelihood of a Major Earthquake

In 2014, the USGS estimated there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043.[40] This was based on a new model, commonly referred to as the third Uniform California Earthquake Rupture Forecast, or UCERF3.[41]

Small earthquakes occur more frequently than large earthquakes.[42] According to the updated model, the probability that an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent. By comparison, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent for the same area, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent. [43]

---

[36] Scawthorn and Blackburn, Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990.

[37] *Id.*, at p. 6.

[38] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2, attached as Appendix K.

[39] *Ibid.*

[40] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

[41] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

[42] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

[43] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

Table 2 below is a simplified version of a table from a USGS fact sheet showing the likelihood of one or more events of varying size for the San Francisco region within the next 30 years based on this new model:[44]

Table 2

San Francisco Region Section of Table from March 2015 USGS Fact Sheet 2015-3009

San Francisco Region		
Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events
5	1.3	100%
6	8.9	98%
6.7	29	72%
7	48	51%
7.5	124	20%
8	825	4%

Although these figures are for the region, and not just the City and County of San Francisco, the predictions are sobering. To put these predictions in perspective, the 1989 Loma Prieta earthquake had a magnitude of 6.9, and, even though the epicenter was approximately 60 miles from San Francisco, it was the largest earthquake to strike the City since 1906. [45] Using the USGS online calculator,[46] a 7.5 magnitude earthquake, which has a 20% chance of happening by 2043, would be almost four times bigger than Loma Prieta, and would release almost eight times the energy. An 8.0 magnitude earthquake would be over 12.5 times bigger than Loma Prieta, and would release almost 45 times the energy. And this is without addressing the risk that the next major earthquake's epicenter could be much closer than 60 miles away.

---

[44] *Id.*, at p.4; Table 2 above is a simplified version of Table 1 of Fact Sheet 2015-3009, attached as Appendix F.

[45] See USGS, M 6.9 October 17, 1989 Loma Prieta Earthquake, https://earthquake.usgs.gov/earthquakes/events/1989lomaprieta/; USGS, M 6.9 - Loma Prieta, California Earthquake, https://earthquake.usgs.gov/earthquakes/eventpage/nc216859/executive.

[46] See USGS, "How Much Bigger ….?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can calculate how much bigger one earthquake is than another.

The USGS has also warned that the pace of large earthquakes is likely to increase:

> In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.[47]

The warnings and predictions from the USGS should be a wake-up call to all of us.

C. The Existing High-pressure AWSS System Only Covers Part of the City

The history and condition of the existing HP AWSS have been described in detail in multiple other reports.[48] Figure 2, on the following page, shows the location of the HP AWSS:[49]

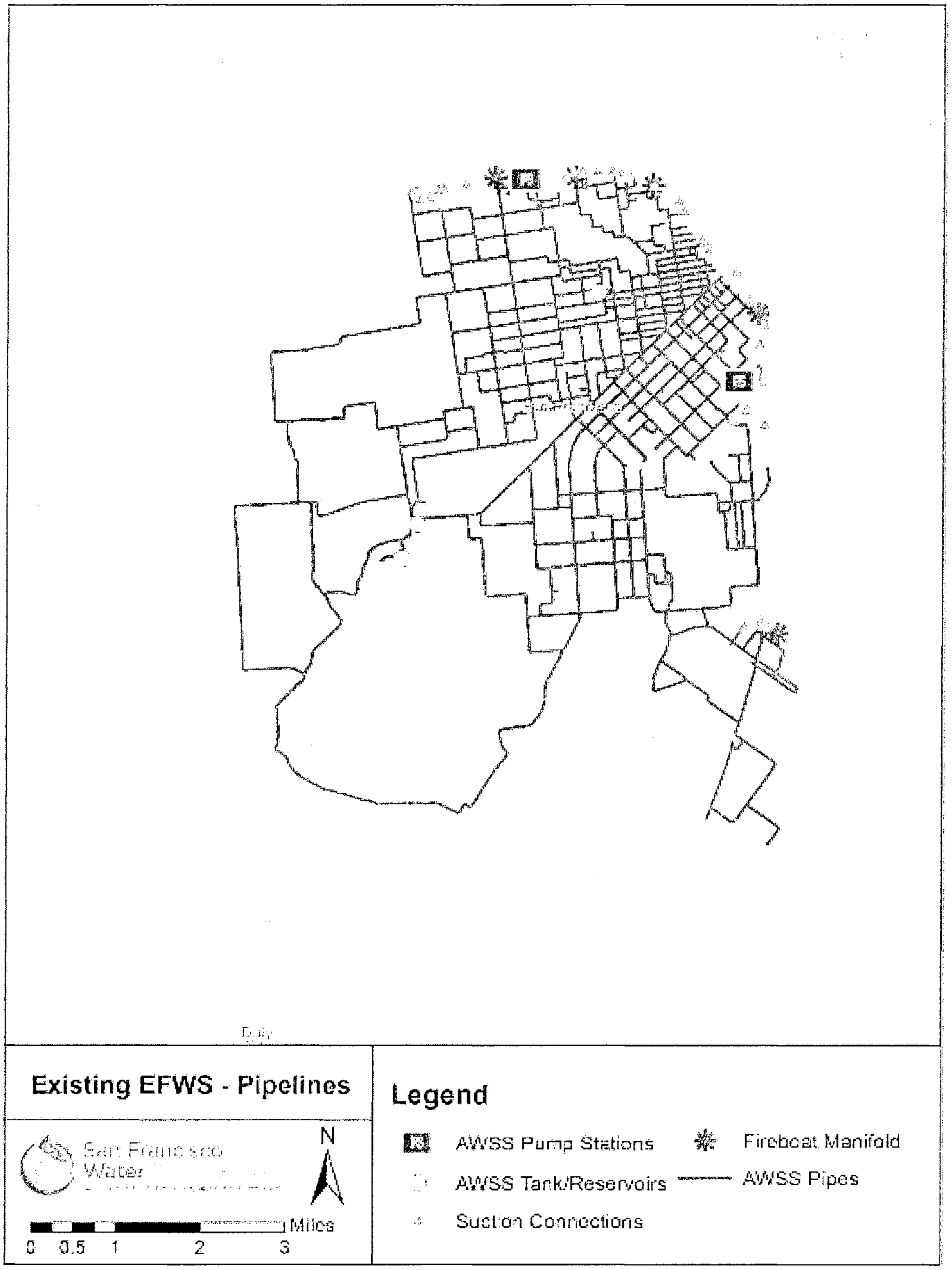
---

47 USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf . See also Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517; *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

48 See, e.g., CS-199, at pp. 7-11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7 .

49 Map supplied by the SFPUC on May 7, 2019.

Figure 3
Map of Existing High-Pressure AWSS



On a district by district basis, Supervisorial Districts 1, 4, 7 and 11 are not nearly as well protected by the HP AWSS as, for example, Districts 3 or 6:[50] See Table 3 below.

Table 3
HP AWSS Hydrants and Miles of Main by District

Supervisorial District	# of AWSS Fire Hydrants	Miles of AWSS Mains
1	42	5
2	170	14
3	327	23
4	3	0
5	188	16
6	366	27
7	79	7
8	110	9
9	110	9
10	222	18
11	24	1
TOTAL	1641	130

In fact, six of the eleven Supervisorial Districts, Districts 1, 4, 7, 8, 9 and 11, each have less than ten miles of AWSS mains. Districts 1, 4, and 11 each have less than 50 AWSS fire hydrants.

The areas not protected by the HP AWSS would need to rely primarily on getting emergency firefighting water supplies from the City's MWSS through its low-pressure hydrants or from cisterns. For a number of reasons detailed below, these resources are unlikely to provide adequate water to protect residents from fires after a major earthquake.

[50] Data provided by SFPUC on March 13, 2019.

D. The Municipal (Domestic) Water Supply System Is "Highly Vulnerable to Catastrophic Failure"[51]

No one knows with certainty what will happen in a major earthquake. But common sense says we should look at past experience and listen to experts when they warn us not to rely on the MWSS for firefighting following an earthquake.

As explained in a 2009 report prepared for the SFPUC,

> By their nature, domestic water mains are more vulnerable to earthquake damage. Numerous service connections and the jointed construction that is the industry norm contribute to their vulnerability.[52]

San Francisco has made a tremendous effort to improve and seismically reinforce its regional and local water system by means of the $4.8 billion Water System Improvement Project (WSIP).[53] The WSIP is one of the largest water infrastructure programs in the nation and the largest infrastructure program ever undertaken by the City. Among its objectives has been reducing the water system's vulnerability to earthquakes, with a particular emphasis on seismically reinforcing the regional delivery system, transmission mains, and reservoirs.[54]

Although the WSIP greatly enhances the reliability of the MWSS, and in particular the transmission mains and reservoirs, the 2009 report emphasizes that, unlike the HP AWSS, the local MWSS system is vulnerable to a major earthquake due to the numerous branches and service connections that can break and drain the system.[55]

This has been borne out by experience in San Francisco and elsewhere. In the 1906 earthquake, an estimated 23,000 breaks in the MWSS resulted in the loss of water and pressure.[56] In the much smaller 1989 Loma Prieta earthquake, there were 69 main breaks and 54 service

---

[51] See SF Fire Commission Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf at p.1. A copy of SFFC Resolution 2010-01 is attached as Appendix M.

[52] Metcalf & Eddy, at p. 18, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The SFPUC has initiated a planning study to better understand the current level of reliability of the entire potable distribution system, focusing on backbone pipes, but that study will take several years to complete.

[53] See SFPUC's WSIP webpage, https://sfwater.org/index.aspx?page=114 .

[54] See, e.g., list of WSIP projects at https://sfwater.org/index.aspx?page=968 .

[55] Metcalf & Eddy, at pp. 18-19, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The Civil Grand Jury is not questioning the importance or the efficacy of the WSIP, which is essential to rapidly restoring potable water service to residents following an earthquake. But fire suppression needs an immediately available supply of water, which the MWSS is unlikely to be able to provide following a major earthquake.

[56] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, p. 6. Other reports have provided somewhat different, but still extremely high estimates. Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 13 [over 28,000 breaks, including service breaks]. But whatever the precise number of water main breaks in 1906, the earthquake devastated the water supply system which contributed to the horrific fires that nearly destroyed the City.

connection breaks in the Marina district alone.[57] Because of these breaks, low-pressure hydrants located in the Marina could not provide adequate water or pressure for firefighting.[58]

Other recent major earthquakes have also caused substantial damage to municipal water supply systems. In the 6.7-magnitude 1994 Northridge earthquake, there were over 1,000 water main breaks and over 100 fires.[59] In the 6.9-magnitude 1995 Kobe, Japan earthquake, "water loss seriously impaired firefighting."[60] There were over 2,000 breaks in the underground piping, and large fires burned freely due to lack of water.[61] Similarly, in the 2011 Eastern Japan earthquake there was extensive damage to water supply lines.[62] Even the relatively small 6.0-magnitude 2014 South Napa earthquake "highlighted the vulnerability of water and wastewater systems to earthquake-related ground failure, the additional fire hazards that earthquake-related water system failures can pose, and the fiscal challenges that public agencies face in improving the seismic resiliency of these systems, both pre- and post-earthquake."[63]

Experts have predicted that in a future major San Francisco earthquake, the MWSS could sustain over 1,000 breaks.[64] Various reports have said it in different ways, but the clear takeaway is that the MWSS should not be relied upon to save the City from fires following a major earthquake:

- "MWSS pipes will sustain damage in certain areas of the City, which will impair the ability to deliver water for firefighting."[65]
- "In such an emergency it is likely that the potable water distribution system would be compromised by pipe breaks and leaks."[66]

---

[57] CS-199, at p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; see also O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996) ("O'Rourke, Lessons Learned").

[58] Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

[59] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 16; O'Rourke, Lessons Learned, at p. 3.

[60] O'Rourke, Lessons Learned, at p. 3.

[61] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 18-19.

[62] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 24.

[63] Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf, Finding 2.3, at p. iii.

[64] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2.

[65] CS-199, p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

- "...the usual firefighting water supplies will almost certainly fail...."[67]
- "World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake."[68]

Moreover, unlike AWSS hydrants, low-pressure hydrants connected to the MWSS require a fire engine to extract and pump the water to sufficient pressure for firefighting.[69] Given that fire engines are likely to be in high demand and potentially overwhelmed in a major earthquake, this is yet another reason why an alternative source of water is necessary.[70]

E. Cisterns Provide Limited Protection

Cisterns are underground tanks, unconnected to any water source.[71] Typically, cisterns in San Francisco hold approximately 75,000 gallons of water.[72]

The City has 229 cisterns located throughout the City, as shown by Figure 4 on the next page[73]:

---

66 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

67 PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 39.

68 SFFC Resolution 2010-01, p. 1, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf and attached as Appendix M.

69 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 55-56.

70 Scawthorn, O'Rourke & Blackburn, 1906 Lessons, at pp. S153-1S54, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf .

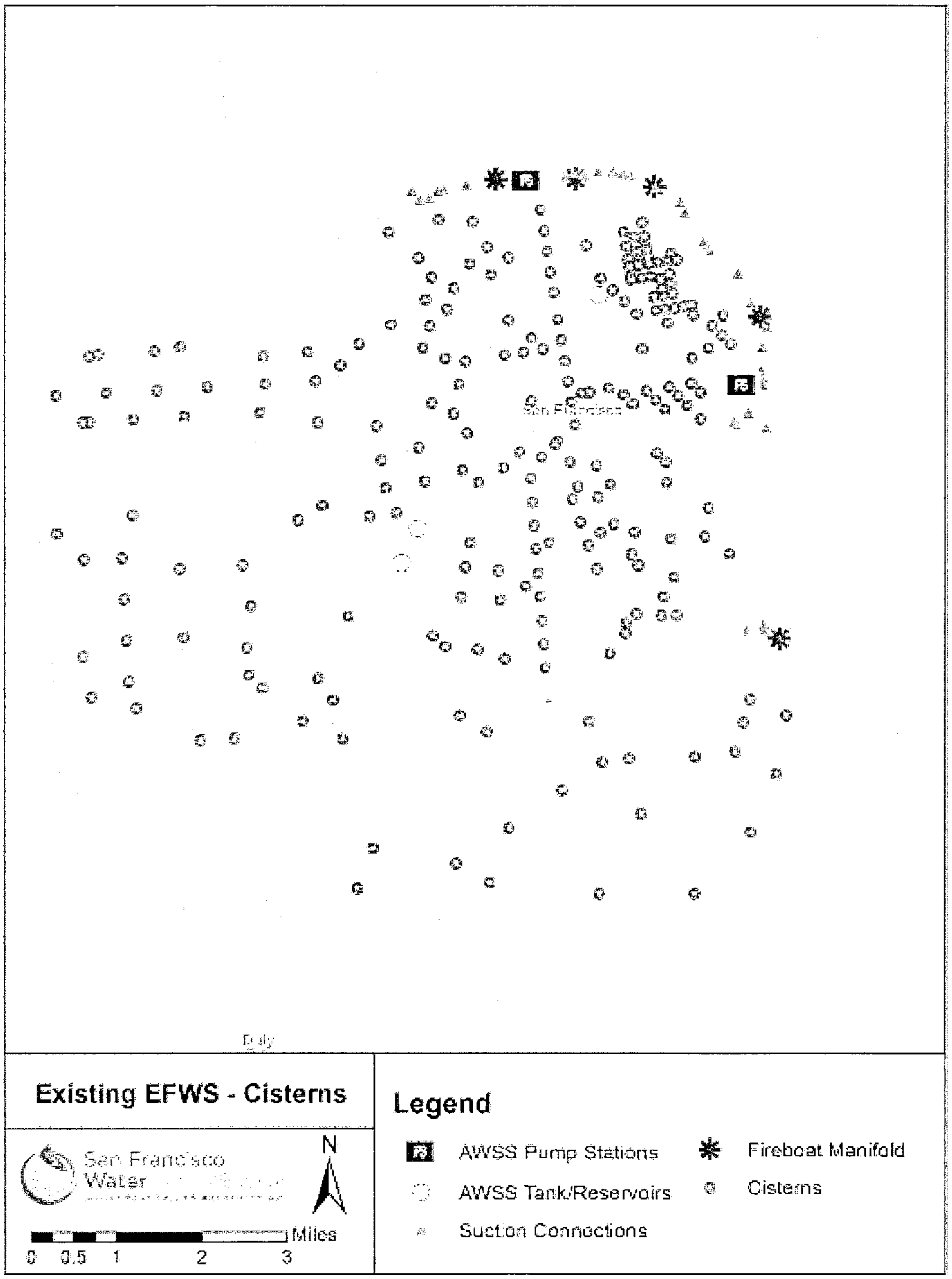
71 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at p. 13.

72 See SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 6.13-6.17; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at p. 77.

73 Map provided by SFPUC on May 7, 2019.

Figure 4

Map of Existing Cisterns



By Supervisorial District, the breakdown of cistern locations is listed in Table 4 below.

Table 4

Cisterns by Supervisorial District

Supervisorial District	Cisterns
1	17
2	23
3	46
4	12
5	20
6	26
7	12
8	27
9	21
10	20
11	5
TOTAL	229

Notably, Districts 1, 4, 7 and 11, which currently have the fewest miles of HP AWSS pipelines, also have the fewest cisterns. This is especially true of District 11, with only one mile of AWSS main pipeline and only five cisterns. [74]

Cisterns provide a valuable backup or "last resort" in the event of damage to the MWSS and AWSS. In the 1994 6.7-magnitude Northridge earthquake, the MWSS suffered over 1,000 water main breaks.[75] Firefighters used backyard swimming pools as water supply sources. In the 1906 earthquake, San Francisco's 23 cisterns were credited with saving a major building in the Financial District when the water mains broke.[76]

Cisterns, however, have limited capacity[77] and are therefore unlikely to be effective against serious fires following a major earthquake. In the 1995 6.9-magnitude Kobe earthquake,

---

[74] In recent years, the SFPUC has built 30 additional cisterns, funded by the 2010 and 2014 ESER bonds. These 30 new cisterns are included in the totals in the above table. Half of these new cisterns were strategically located in the Richmond and Sunset districts, which now have 17 and 12 cisterns, respectively, to begin to address concerns that those areas of the City were inadequately protected. SFPUC 2017 FAQ, Question 4, https://sfwater.org/modules/showdocument.aspx?documentid=11507 .

[75] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at pp. 12-17.

[76] Scawthorn 1987, http://www.sparisk.com/documents/AIRACFFEs.pdf , at p. S140.

[77] SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 5.6-5.7.

however, the city's 968 cisterns provided little help to firefighters because they drained in 10 minutes.[78]

San Francisco's typical cistern would drain within an hour of continuous firefighting.[79] Given that on average it takes several hours to put out a four-alarm fire,[80] cisterns cannot be expected to successfully fight post-earthquake conflagrations in parts of the City not protected by AWSS. In addition to providing limited firefighting water, cistern water must be extracted and pressurized by an engine, requiring more staff and time to deploy than, for example, AWSS hydrants.[81]

F. The PWSS Inventory Needs to Be Modernized and Expanded

In addition to the MWSS and cisterns, the SFFD intends to rely on the City's Portable Water Supply System, or PWSS, to fight fires in non-AWSS areas.

In the 1980s, the SFFD developed and implemented the PWSS, an above-ground, large-diameter hose system used to move water great distances from a water source to a fire. PWSS units consist of a hose tender, or truck, equipped with approximately one mile of large-diameter five-inch hose (larger than the normal three-inch hose), along with a portable pump, portable hydrants that allow water to be distributed from a large-diameter hose, and other essential firefighting equipment.[82] With its portable pump, a hose tender can be used to draft and pressurize water from alternative water sources, such as lakes, lagoons, a fireboat (as in the 1989 Loma Prieta earthquake), cisterns, or even broken water mains. It can also be used to extend the reach of the HP AWSS system to blocks or neighborhoods without a HP hydrant.[83]

---

[78] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 17-19. San Francisco's cisterns are larger than Kobe's, but the point remains they are only good for a limited duration. *Id.*, at p. 77.

[79] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 77.

[80] Information provided by SFFD.

[81] CS-199, at pp. 13, 56, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[82] Scawthorn, O'Rourke, Blackburn, S150-151. A detailed description of the PWSS can be found in Scawthorn, C. and Blackburn, F. (1990), Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC. The PWSS and its five-inch hoses are different from a prior, abandoned concept of a Flexible Water Supply System, using massive, 12-inch hoses in lieu of expanding the HP AWSS. That concept was proposed in AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246. It was abandoned as impractical after concerns over, among other things, how 12-inch diameter hoses would block traffic.

[83] Figure 6-1 on page 83 of CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, is a map of the City showing how the PWSS can be used to expand the areas protected by the AWSS. Figure 6-1 assumes certain extensions of the AWSS

Currently, there are only five PWSS hose tenders, three of which are located in the "unprotected areas"[84] of the Sunset district and Hunter's Point. In the SFFD's opinion, the PWSS hose tenders are "past their useful life."[85] The newest hose tender, housed in the Sunset, is 27 years old. The second newest, in Hunter's Point, is over 30 years old. The remaining three are over 45 years old.[86]

Firefighters and emergency response experts have been calling for a large-scale expansion of the PWSS for years.[87] In January 2010, the San Francisco Fire Commission (SFFC) issued Resolution 2010-01, encouraging the SFFD to pursue approximately $10 million in grant funding to expand the PWSS. The SFFC recognized that the City's MWSS is highly vulnerable to a catastrophic failure in the event of a major earthquake, and that the AWSS does not cover the entire City. The SFFC declared that the PWSS has been proven effective in the above-ground transmission of water for firefighting, that the PWSS can work in conjunction with and supplement the AWSS, and that the City did not have a sufficient number of units to supply all areas of the City where the AWSS does not extend.[88] Unfortunately, that grant was not funded, and the City has not yet purchased any additional PWSS hose tenders.[89]

Also in 2010, the Applied Technology Council issued several reports as part of the City's Community Action Plan for Seismic Safety, or the "CAPSS Project."[90] Among its recommendations was one similar to ours: Improve emergency water supply systems to cover those neighborhoods not served by the HP AWSS. As explained in that report,

> The Auxiliary Water Supply System provides a redundant water system for fighting fires after earthquakes and at other times, and incorporates many earthquake resistant features in its design. However, this system covers only northern and eastern City neighborhoods, those that were developed in the early

---

that do not presently exist, and does not take into consideration the limited size of the existing PWSS inventory. As a result, Figure 6-1 in CS-199 overstates the current level of protection, but does show what could be accomplished with a larger inventory of PWSS hose tenders.

[84] These areas are of course not completely unprotected, but as discussed above they do not have a HP AWSS. The City's outside expert AECOM/AGS, A Joint Venture, has referred to the portion of the City protected by the HP AWSS as the "Protected Area." See CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[85] Information provided by SFFD.

[86] Information provided by SFFD.

[87] See Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990, attached as Appendix Q.

[88] SFFC Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf

[89] Information provided by SFFD.

[90] According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts. See https://sfgov.org/esip/capss .

part of the last century when the system was constructed. *The City needs adequate, reliable water sources to fight post-earthquake fires in all neighborhoods. There are a number of options to improve the water supply in neighborhoods not served by the Auxiliary System, including expanding the City's Portable Water Supply System, which can be deployed wherever needed. This important issue needs to be addressed as soon as possible.* (Emphasis added)[91]

In 2014, outside consultant AECOM/AGS, a Joint Venture, advised the City that "[a]dditional PWSS units would be a prudent investment for SFFD/SFPUC."[92]

The SFFD submitted a request for funding to purchase 20 newly designed PWSS hose tenders in the fiscal year 2019/2020 budget, but the Civil Grand Jury understands that only four new PWSS hose tenders are included in the Mayor's May 31, 2019 two-year budget proposal.[93] The proposed new SFFD hose tenders are designed to be more efficient and maneuverable than older models, with four-wheel drive to overcome obstacles on roads, the ability to carry up to 6,000 feet of five-inch fire hose, and only one firefighter required to operate each vehicle. Each vehicle will have a high-volume onboard water pump, and a portable submersible water pump. Both pumps will be able to draft water from the Bay, reservoirs, or other water sources. These new hose tenders could be connected together to carry water over many miles of the City. The SFFD estimates these new PWSS vehicles, fully equipped with hoses and appliances would cost approximately $1 million per vehicle.[94]

Given the time required to build or extend a HP pipeline system, acquiring additional PWSS hose tenders is a practical intermediate step to enhance fire protection throughout the City. The SFFD advised the Civil Grand Jury that additional PWSS hose tenders could be acquired and in service within a year or so, or at the outside two years. The failure to obtain grant monies should not stop the City from making this important investment in public safety.

Although the Civil Grand Jury recommends immediately replacing and expanding PWSS units, this is not a long-term solution. A successful PWSS deployment requires a nearby water source, and personnel to unwind a mile of heavy, five-inch-diameter hose through potentially

---

[91] Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety (2010), prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project, at pp. 53-54, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

[92] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 85. Although this report referred to the PWSS as an investment in the colloquial sense, the PWSS is not a fixed asset and thus does not involve a capital expenditure. As such, purchasing new hose tenders will need to come from city funds, not bonds. The Civil Grand Jury nevertheless believes that acquiring more PWSS hose tenders is long overdue.

[93] Information provided by SFFD. The City's budget process is of course ongoing. It is therefore uncertain whether the Board of Supervisors will approve sufficient funding for the four new units or conversely whether the Board of Supervisors will increase the funding for purchasing new PWSS units. We also understand that a request for funding for PWSS hose tenders has been made to state officials, but at this time the SFFD does not know if that request has been approved.

[94] Information provided by SFFD.

congested and damaged city streets. [95] Moreover, although hose tenders can draft water from the Bay, they are not designed for use in the ocean – the only unlimited water source on the west side of the City.[96] Given these challenges, PWSS is essentially an important but temporary "Plan B."

G. Efforts to Expand the High-Pressure AWSS Need to Be Accelerated

As discussed in Section B above, the USGS estimates there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area before 2043.[97] In early April of 2019, USGS researchers issued a new study warning that "the next 100 years of California earthquakes along [the San Andreas, San Jacinto and Hayward] faults could be a busy one."[98] Each year we delay construction of an expanded HP AWSS we are gambling, pushing our luck that a major earthquake won't hit before we're ready.

City departments, including the SFPUC, which assumed jurisdiction over the operation and maintenance of the AWSS from the SFFD in 2010, have been analyzing the reliability of the EFWS and the possible expansion of the HP AWSS for over a decade.[99] An analysis in 2009 indicated that the EFWS was "47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake."[100] In actuality, and as discussed in Section I below,[101] the SFPUC's consultant's metric is overly optimistic: a 50% score really means that we will have about half of the water needed to meet *median* firefighting demands following a 7.8-magnitude earthquake. Put differently, if the firefighting demands are above the median estimate, this analysis indicates that even with a score of 99% there will be insufficient water to meet the demand.

---

[95] Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, at pp. 4-5; information provided by SFFD.

[96] According to the SFFD, there is no known SFFD access to the ocean on the western side of the City, but SFFD is continuing to investigate potential access areas where it might be able to use a PWSS unit.

[97] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020, https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

[98] See *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[99] See e.g., Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, CS-199 (2014), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229 (2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, 2018 Westside Options Analysis (2018), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, among other reports.

[100] SFPUC FAQ, Question No. 3, https://sfwater.org/modules/showdocument.aspx?documentid=11507 and attached as Appendix N.

[101] See pages 35-36 below.

Figure 5, below, shows EFWS reliability by so-called Fire Response Areas (FRAs)[102] as of 2010, i.e., prior to recent improvements.

Figure 5
Map of EFWS Reliability Scores by FRA as of 2010[103]

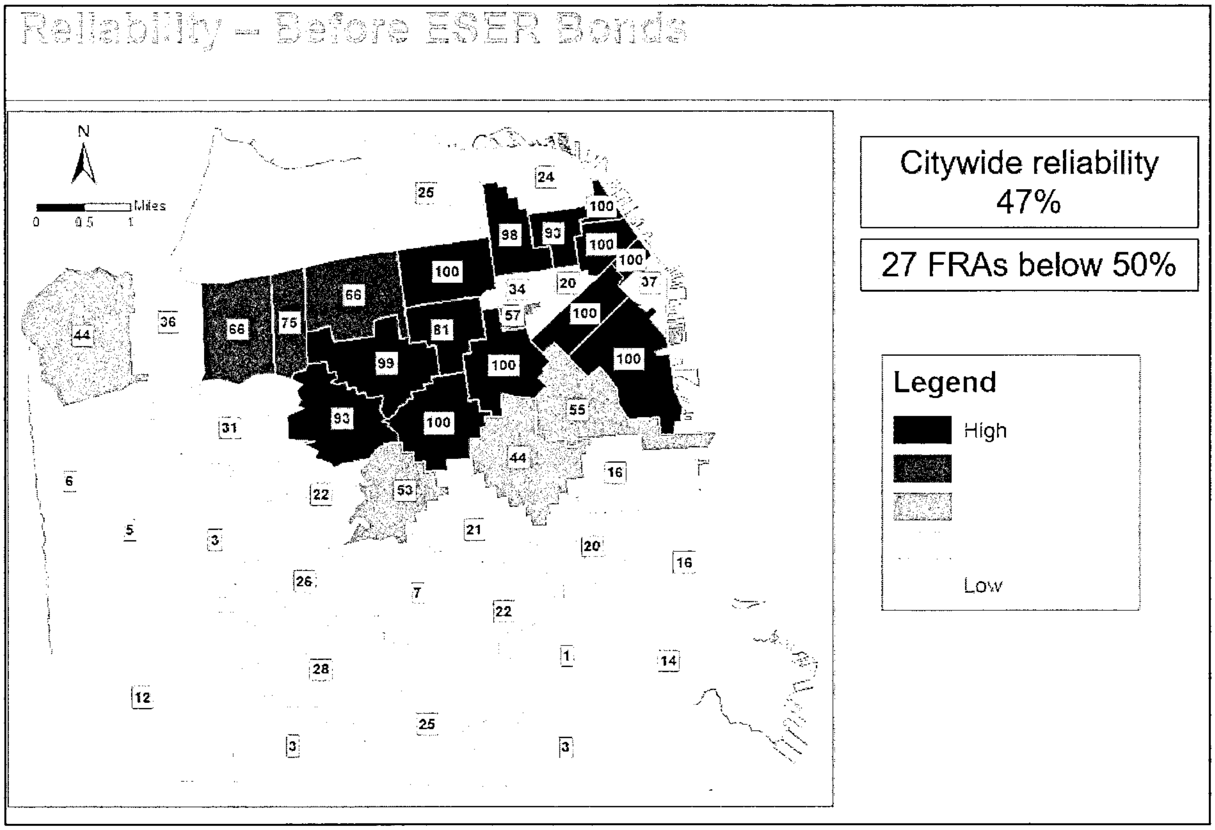


Figure 5 shows that as of 2010 the majority of the City scored below 50%, and in some cases far below. In 2010 and again in 2014, voters approved Earthquake Safety and Emergency Response (ESER) Bonds. The 2010 ESER bonds provided approximately $102 million for the EFWS, and the 2014 ESER bonds provided $54 million. The money was spent on assessing the existing HP AWSS, rehabilitating and upgrading core facilities (existing water storage tanks, pipelines, salt-water pumping stations) that needed seismic strengthening or other repairs or improvements, adding 30 cisterns, and other tasks.[104]

---

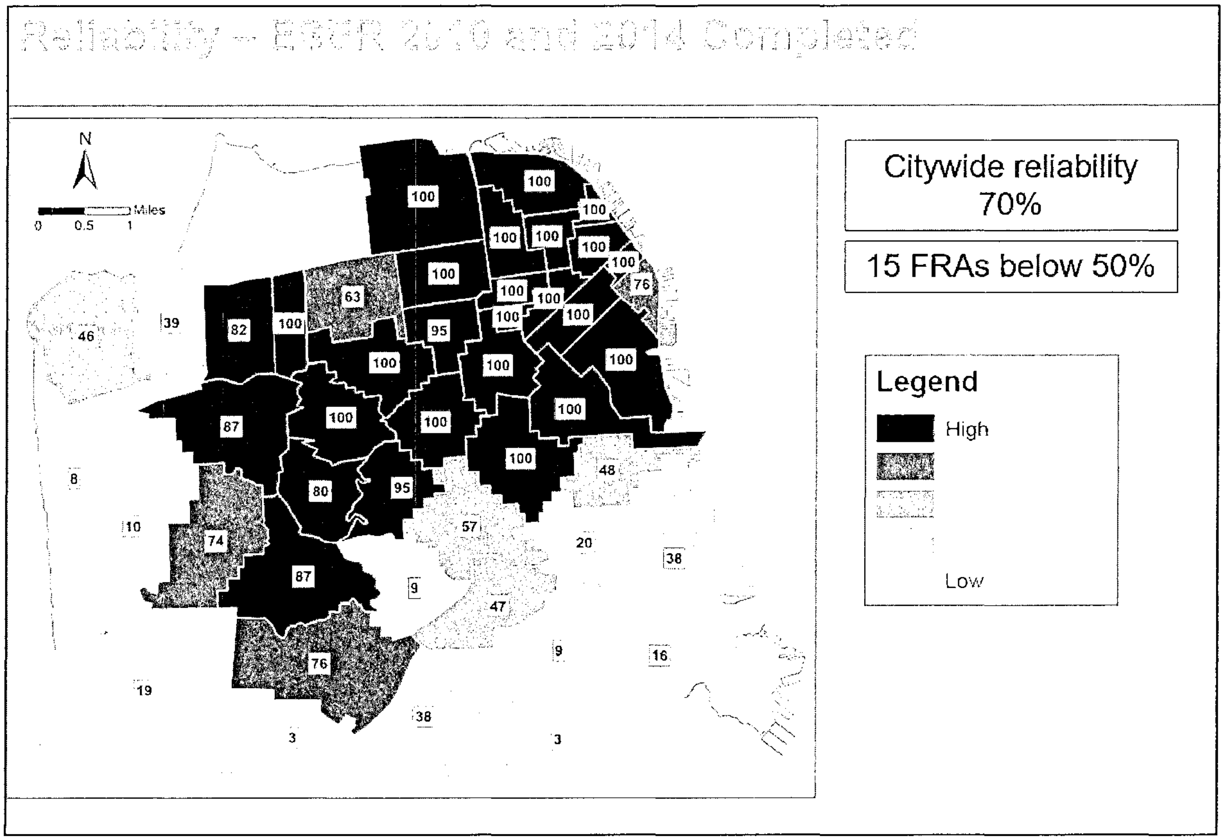
[102] The SFFD divides the City into 46 areas for initial alarm response, also referred to as Fire Response Areas or FRAs. A map showing the different FRAs is attached as Appendix J.

[103] Map supplied by SFPUC. Identical map, except for legend, in AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907 at p.3.

[104] A February 26, 2019 status list provided by the SFPUC for the various projects undertaken pursuant to the 2014 and 2014 ESER bonds, showing which are in planning, in design, in construction, complete, canceled or

The result has been significantly improved EFWS reliability scores, as shown by Figure 6:

Figure 6
Map of EFWS Reliability Scores by FRA After 2010 and 2014 ESER Bond Work Completed [105]



The SFPUC has performed important work in analyzing what needs to be done and by repairing existing facilities. *But today, nine years after the 2010 CAPSS report called for action as soon as possible, 16 years after the 2002-2003 Civil Grand Jury called for expanding the HP AWSS to the entire City, almost 33 years after the 1986 Fire Protection Bonds Analysis stating*

postponed is attached as Appendix O. See also Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found at http://www.sfearthquakesafety.org/eser-reports.html

[105] This map assumes completion of work in progress, which is expected by late 2020 according to the SFPUC. The SFPUC has retained outside experts to update the anticipated water demands by FRA but that work has not been completed.

the improvements would include extending the HP AWSS and installation of a HP pump station at Lake Merced, and over a hundred years after the AWSS system was first built, we are still decades away from reliably protecting all neighborhoods.

Over the past year, the SFPUC has made substantial progress in developing plans to improve EFWS on the west side. Specifically, the SFPUC and the SFFD propose to develop a new, separate AWSS system using potable water ("Potable AWSS") for the western part of the City. The Potable AWSS approach contemplates a dual-purpose pipeline, independent from the existing HP AWSS network.[106] The Potable AWSS would function as a potable water transmission main during normal operations and would provide HP emergency firefighting water supply for major fires. The new pipeline would provide "daily reliability and water quality benefits as well as a post-earthquake potable water supply to the Richmond and Sunset districts",[107] but in the event of an earthquake or other emergency, the transmission main would automatically be isolated from the remainder of the potable distribution system and converted to a dedicated HP system, similar to the existing or conventional AWSS.[108] To increase reliability, the new pipeline would be made of modern, seismically reliable material.[109]

The SFPUC currently anticipates having approximately $195 million,[110] from water rates and from an expected 2020 ESER bond (assuming voter approval), to spend on extending the HP AWSS and improving EFWS reliability over the next five to seven years.[111] The current Potable AWSS proposal is divided into two phases, as the projected $195 million is insufficient to

---

[106] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at pp. 7, 10, 13.

[107] *Id.,* at p. 8. The Potable AWSS would eliminate the need for a project that the SFPUC had been planning to supply potable water to the Richmond District, saving up to $30 million. *Id.* Today the potable water supply to the Richmond District depends on two transmission mains that run north from the Sunset District. One of those mains was built in 1915. The other was recently replaced with a ductile iron main. The Potable AWSS would provide a third transmission main, built with modern earthquake resistant pipe. *Id.*, at p. 13.

[108] A detailed description of the Potable AWSS concept can be found in CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229, https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, and 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740. The actual proposal has evolved over time, so the alignment discussed in those 2014, 2015 and 2018 reports has changed, as have the water sources. This plan is still under review and the alignment may well change again before the plan is finalized and ready for any required public hearings or environmental or other review. But the underlying concept of a Potable AWSS and how it would operate remains the same.

[109] New pipe would be so-called Earthquake Resistant Ductile Iron Pipe (ERDIP), the most seismically reliable pipe available. ERDIP pipe performed admirably in several recent Japanese earthquakes See Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 6, re ERDIP pipe.

[110] Information supplied by the SFPUC. The $195 million is adjusted for inflation as the build out will occur over several years. This is roughly equivalent to $160 million in 2018 dollars according to the SFPUC.

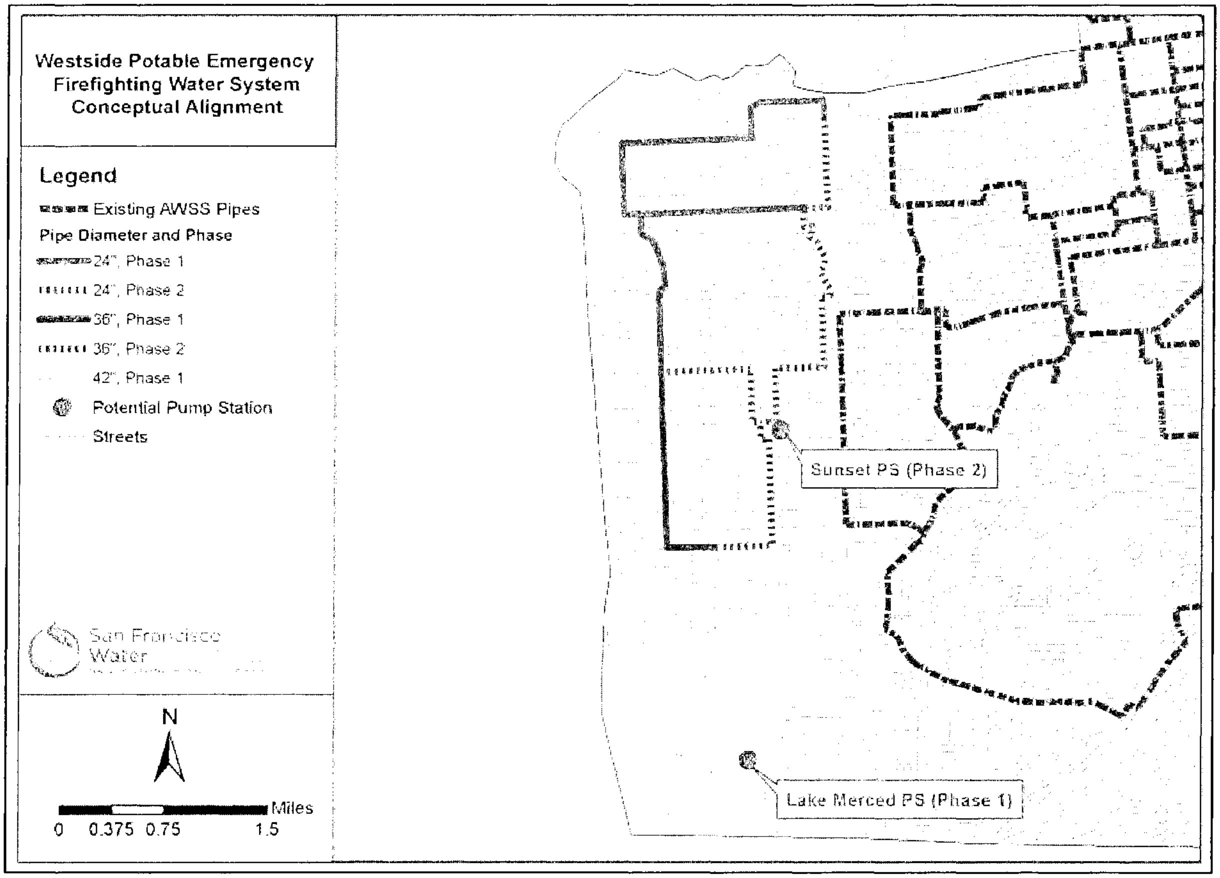
[111] Meetings with SFPUC representatives. The Board of Supervisors approved the 2020-2029 ten-year Capital Plan at its April 30, 2019 meeting. See https://sfbos.org/sites/default/files/bag043019_minutes.pdf . The new ten-year Capital Plan can be found at http://onesanfrancisco.org/the-new-plan/overview .

complete the entire project. Phase 1 involves adding approximately 8.6 miles of new pipe.[112] A conceptual potential pipe alignment would extend north from Lake Merced along the west side, through the western portion of the Sunset and Richmond districts, and then have two pipelines head east, one immediately south of the Presidio and one in the southern Richmond district.[113]

A conceptual potential alignment of both Phase 1 and Phase 2 is shown in Figure 7 below:[114]

Figure 7

Conceptual Potential Alignment for Potable West Side AWSS



[112] Information provided by SFPUC. The phasing and the potential, proposed or conceptual alignment discussed above and on the following pages are still in the planning stages and are subject to change. Detailed designs have not yet been completed, much technical analysis remains to be done, and the project has not yet undergone environmental reviews.

[113] The current furthest west AWSS pipeline is located east of Park Presidio Boulevard.

[114] Provided by the SFPUC on April 10, 2019. See footnote 121 on page 32.

The Potable AWSS pipeline network would tie into an existing, recently seismically reinforced, potable 60-inch transmission main, providing a source for normal, potable-water operations.[115] The proposed Phase 1 also includes adding a new HP pumping station at Lake Merced.[116] Although the water in Lake Merced is deemed non-potable, Lake Merced contains approximately a billion gallons or more, making it an excellent source of water for emergency firefighting purposes.[117]

The SFPUC and SFFD's future west side plans (Phase 2) include an additional 5.6 miles of pipeline for better coverage and potentially an additional pumping station at Sunset Reservoir, for another source in case of a broken pipe or other emergency.[118] However, the SFPUC and the SFFD do not anticipate having the additional approximately $120 million[119] needed to complete that portion of their plan until the next round of ESER bonds, which may not be for another five to seven years or even longer.[120]

Unfortunately, the Potable AWSS on the west side only addresses the EFWS deficits on the west side of the City. Many other City neighborhoods along its southern part, from Park Merced in the west to Visitacion Valley in the east, will be no closer to having a multi-sourced, seismically reliable HP AWSS or substantially enhancing their neighborhood's EFWS even if this westside Potable AWSS plan moves forward.

---

[115] According to the SFPUC, this transmission main connects to both (a) the Crystal Springs Reservoir in San Mateo County and to the 9'6" Crystal Springs Bypass tunnel, which is supplied by Calaveras Reservoir, San Antonio Reservoir, and the SFPUC's upcountry water sources (Hetch Hetchy, Don Pedro, etc.). These potable water sources were seismically reinforced by the SFPUC's Water System Improvement Program (WSIP), a $4.8 billion program to improve water system reliability, including seismic reliability. See SFPUC webpage on WSIP, https://www.sfwater.org/index.aspx?page=114 .

[116] Like the conceptual potential pipeline alignment, the size, location and design of any new pumping station is at present unknown and uncertain. The Civil Grand Jury understands that the Potable AWSS project is currently moving forward with design, technical studies, environmental and management reviews, but is of course also dependent upon approval of necessary funding.

[117] Information provided by SFPUC; see also V. Matuk and N. Salcedo, Lake Merced Hydrology and Water Quality, http://online.sfsu.edu/bholzman/LakeMerced/water.htm ("Estimates of the capacity of the lake also vary greatly from a low of 768 million gallons to high of 1.93 billion gallons."). The Sunset pumping station shown in the figure on the preceding page is being considered as a potential part of Phase 2.

[118] Per the SPFUC, the Sunset Reservoir Pumping Station will also be connected to a seismically reinforced, potable 54-inch transmission main. Unlike the northeast quadrant, where the AWSS pipeline system is a grid and thus provides an excellent measure of redundant support in case of a broken pipe, the proposed Potable AWSS would not be a grid. The lack of redundant pipelines creates a somewhat higher level of risk. However the use of modern ERDIP significantly reduces the risk of pipeline failure, and having redundant water sources provides additional comfort as it would enable back-feeding and reduces the risk of a potential single point of failure. 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

[119] This cost estimate is in 2018 dollars. Unless otherwise stated, all cost estimates provided by the SFPUC, SFFD and SFDPW to the Civil Grand Jury for work on the EFWS system and discussed in this report are in 2018 dollars.

[120] Even if new bonds are issued in five to seven years, design and construction of the new pipelines and new pumping station would take several more years.

The limited scope of the SFPUC's current plans is the result of budgetary constraints. The Mayor and the Board of Supervisors determine what bond proposals are placed before the voters, how frequently, and what is included. The SFPUC and the SFFD must operate within the financial constraints they are given.

The SFPUC has rough estimates showing that extending the high-pressure AWSS throughout the City–or building separate but functionally equivalent Potable AWSS systems in areas without a HP AWSS–will cost approximately $500 million in addition to the funds already targeted for Phase 1 of the Potable West Side system, as discussed above.[121] The SFPUC is not presently planning a programmatic City-wide expansion; it merely has developed a rough list of possible projects for various parts of the City that are not presently served by the HP AWSS (as well as other projects to reinforce or otherwise improve the HP AWSS system in those areas that are currently served by the HP AWSS).[122]

This roughly $500 million estimate is a huge amount of money, but as discussed in Section A above, the risk of incurring the costs from a major, inadequately-fought fire is far greater.

First and foremost is the risk to human life. In 1906, an estimated 3,000 people lost their lives, and 225,000 were left homeless. The City is obviously much better prepared today, with

---

[121] See "Candidate EFWS Projects" list dated May 8, 2019, attached as Appendix P. The actual total of projects related to system expansion is approximately $485 million, plus the $160 million for Phase 1 of the Westside project, for a total of $645 million. We have rounded the $485 million up to $500 million for the sake of simplicity and in recognition of the fact that these are all very preliminary high level estimates.

This Candidate EFWS Projects list is an internal SFPUC document: it is a list of potential project alternatives provided by the SFPUC staff to the EFWS Management Oversight Committee. The list contains potential projects that could be implemented in the future if approved by the EFWS Management Oversight Committee, if funding is made available, and if and when they go through the required environmental review. Due to the preliminary nature of the list, some of the estimated costs on this candidate project list are merely planning level estimates and would likely change if the SFPUC decided to move forward with a detailed design for a given project. Some of these projects, such as the Potable AWSS on the west side, are moving forward towards completion of design and technical studies and required environmental review based on management direction and the anticipated availability of funds. However, others are still simply candidate project alternatives that management may never proceed with.

This May 8 Candidate EFWS list also includes various proposals and potential projects to improve the seismic safety of the approximately 20 miles of HP AWSS pipes in the so-called infirm zones, as well other supply or proposed projects under consideration unrelated to any potential HP AWSS expansion. May 8, 2019 Candidate EFWS Project list attached as Appendix P; see CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 31 for a map of infirm zones.

Although the original AWSS system was designed to be seismically strong, and to survive an earthquake, it was designed shortly after the 1906 earthquake and installed by 1913. Most of the AWSS pipelines fared well during the Loma Prieta earthquake, although that was 60 miles away and not as big an earthquake as we will someday face. See, e.g., PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 9-12. Accordingly, no one knows for certain how the existing AWSS will fare in a major earthquake, especially in liquefaction areas or so-called infirm zones. The infirm zone projects, which are estimated to cost $135 million, involve installing new, backbone ERDIP pipe in each infirm zone, so that even if the existing AWSS pipe fails there will be at least one reliable major high-pressure pipeline in each area. Information provided by SFPUC; see also Appendix P.

[122] The recently approved 2020-2029 ten-year Capital Plan does not designate nearly enough money for EFWS to complete a City-wide expansion of the HP AWSS system. See http://onesanfrancisco.org/the-new-plan/overview

fire suppression systems, the existing HP AWSS, and modern building standards. Yet the 2017 North Bay fires and the 2018 Camp fire that destroyed the town of Paradise demonstrate how destructive and fast-moving fires can be under windy conditions. [123] In 1906, residents fled to the south and the west, to relatively uninhabited portions of the City that did not burn. Today, the entire City is densely populated and there would literally be no place for residents, especially our many senior citizens, to run to escape a fast-moving conflagration.

Second, in terms of property value, San Francisco has billions of dollars at risk. As discussed in Section A of this report, and in particular Table 1, a 2010 report prepared for the City estimated the range of losses due to fire following an earthquake could exceed $10 billion for a 7.9-magnitude event – in 2010 dollars. The damage estimates in Table 1 do not include business interruption losses, loss of tourism or loss of property tax revenues, all of which would undoubtedly be substantial.[124]

The substantial increase in San Francisco property values over the last decade undoubtedly increases the potential losses. In light of the dire consequences we face, the approximately $650 million price tag to expand the HP AWSS throughout the City (which includes Phase 1 of the proposed Potable AWSS on the west side), seems well worth the expenditure.

The Civil Grand Jury is not in a position to know whether each of the SFPUC's potential projects is essential, how the costs will change after detailed design work, further studies and environmental reviews, or whether more cost-efficient approaches exist. We are also not in a position to weigh the relative merits of the approximately $320 million in non-expansion-related projects on the SFPUC's Candidate EFWS Projects list.[125] But we do know that the current approach is taking too long. The SFPUC itself estimates that build-out of the AWSS "would take ~ 35 years using current funding rate assuming 5 year bond cycle."[126]

The most recent public timeline provided by the SFPUC is in CS-199, and is moot as the various projects have evolved over time. However, that timeline relies upon the issuance of

---

[123] As discussed above, wind is a major factor in fire spread. See, e.g., Kearns, F. and Moritz, M., *The Conversation* (November 16, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985; Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp. 8-9, 15, 18-19. The 1923 Tokyo earthquake and subsequent fires are probably the most devastating in peacetime, with substantially greater loss of life (an estimated 140,000 killed) than the 1906 earthquake. See Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019 at pp. 1-2, 19-23; see also Great Tokyo Earthquake of 1923, at http://factsanddetails.com/japan/cat26/sub160/item2226.html. Among the reasons for the devastation in Tokyo were winds of approximately 28 miles per hour at the time of the earthquake, with increasing wind throughout the day. *Id.*

[124] See CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 95-97.

[125] See May 8, 2019 Candidate EFWS Projects list, attached as Appendix P.

[126] SFPUC Emergency Firefighting Water System, Management Oversight Committee presentation dated March 4, 2019, at p. 32. The City is not committed to a five year bond cycle, so it could be even longer, although the increased level of funding in the proposed 2020 ESER bond indicates that things may be moving more rapidly.

ESER bonds every five to seven years, through and including a 2045 bond issuance, such that work would not be completed until 2049.[127]

Either way, this means that areas of our City, such as District 11, would not be as well protected as other areas, and would not have a HP AWSS in place if, as predicted by the USGS, a major earthquake hits the Bay Area before 2043.

Accordingly, the Civil Grand Jury recommends a major acceleration of these efforts, such that all areas of the City are protected by a seismically sound, multi-sourced, HP emergency water firefighting system within 15 years, i.e., by no later than 2034.

H. The Bottom Line: Act Fast, but Ensure Redundancy

Among the most important factors in designing an EFWS is redundancy. This is true whether the City chooses to extend the existing AWSS or to adopt a different approach. Regardless of the specific plan, there must be multiple, redundant sources of water such that if one source fails or a pipe breaks, firefighters have other means to obtain necessary water supplies.

In the Loma Prieta earthquake the Marina district was saved by the combination of the PWSS and a fireboat, or "the backup to the backup."[128] Unpredictable stuff happens, especially in a major earthquake, and redundancy is necessary.[129] This means not just looped pipe systems but also multiple sources of water. One of the great ironies of the 1906 earthquake is that San Francisco is surrounded by water yet it burned due to a lack of water.

The original HP AWSS was designed with both a redundant water supply and a gridded main system.[130] The system in the northeast quadrant of the City "seeks high post-earthquake

[127] Figure 5-1, *Preferred Alternative Planning Level Schedule,* from CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 71, and attached as Appendix R.

[128] See Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992); Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC; Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018).

[129] See, e.g., Metcalf & Eddy, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00 at p. 20; CS-199, at p. 11 ("Multiple redundancies in fire water supply systems are necessary."), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[130] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

reliability via multiple sources of supply."[131] Those sources include two above-ground storage tanks, a reservoir, two salt-water pumping stations, plus several fire boat manifolds if needed.[132]

Many citizens have called for installing a salt-water pump station or stations on the west side, arguing that the ocean provides an unlimited source of water.[133] A salt-water pump station north of Golden Gate Park would also provide geographic diversity of water sources, as the other proposed pumping stations and HP water sources are all south of Golden Gate Park. Dr. Scawthorn, the City's consultant, has asserted that a salt-water pump station on the west side "would be very beneficial."[134]

The Civil Grand Jury recognizes that this may raise environmental and other issues, and may or may not be necessary in light of the potential use of Lake Merced.[135] Nevertheless, the Civil Grand Jury strongly believes in having redundant and geographically diversified water sources, and developing a robust water source in the northwest quadrant of the City seems to us to be beneficial. Other areas of the City have added protection from the SFFD's four fireboats, which can be connected to the PWSS to provide an alternate water supply, as in Loma Prieta. Unfortunately, fireboats are not designed to work in the open water of the Pacific Ocean, and PWSS hose tenders cannot practically drive onto beaches to draft water from the ocean.[136] For these reasons, a salt-water pumping station on the west side seems particularly appropriate.

The need for further EFWS projects is underscored by two additional considerations, discussed more fully below. First, the reliability scores cited in the SFPUC's consultant's reports over-state how effective our current plans are likely to be upon completion. Second, these scores – and our safety – are predicated on being able to properly maintain and operate the existing AWSS assets, especially critical assets, so they are ready when needed.

---

[131] Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 2.

[132] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 7-8.

[133] Pendergast, T, *Plan to Protect Neighborhood Abandoned*, Richmond Review (November 2017), https://sfrichmondreview.com/2017/11/02/plan-to-protect-neighborhoods-abandoned/ ; Fracassa, D, *SF Moves to Build Water System to Fight Fires for When the Worst Hits*, San Francisco Chronicle (February 11, 2018), https://www.sfchronicle.com/politics/article/SF-moves-to-build-water-system-to-fight-fires-12605847.php ; Doudiet, T., *Commentary–Sound the Fire Alarm!*, Richmond Review / Sunset Beacon (November 3, 2017), https://sfrichmondreview.com/2017/11/03/commentary-thomas-w-doudiet/ ; Wuerfel, N., *Commentary–SFPUC Misleads Public*, Richmond Review / Sunset Beacon (November 13, 2018), https://sfrichmondreview.com/2018/11/13/commentary-nancy-wuerfel-2/ .

[134] Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, at p. 7.

[135] Any plan to add a salt-water pump station would need to be responsive to concerns about reducing or even eliminating if possible any impacts on marine life.

[136] Information provided by the SFFD.

I. Current FRA Reliability Scores Promote Overconfidence

The SFPUC's and the SFFD's goal is to provide a certain Level of Service (LOS) for emergency firefighting water supply throughout the City. In particular, the SFPUC has articulated the following LOS objective:

> AWSS will reliably provide water to supply the "probable fire demands" after a magnitude 7.8 San Andreas earthquake. Each FRA will have a minimum of 50% reliable water supply to meet probable fire demands. The Citywide average will be a minimum of 90% reliable water supply to meet probable fire demands.[137]

The Civil Grand Jury agrees with the goal that the City should be prepared to fight fires following a magnitude 7.8 San Andreas earthquake. However, we are concerned with the current measures of "reliability." As discussed below, the "reliability scores" being used by the City create a misleadingly optimistic impression and imply a false precision.

As explained in CS-199, "[i]n the context of this study, reliability is defined as the percentage of the water demand met by AWSS high-pressure system and other sources."[138] Put differently, the reliability score methodology "does not actually represent an estimate of reliability but is a ratio of the EFWS capacity and demand."[139]

The ratio of capacity and demand is a useful measure, but the scores being used are overly optimistic in that the estimated "demand" used is the *median* estimated demand.[140] By definition, half the time one would expect worse conditions and therefore greater demand for water to fight fires. Using a demand estimate that is by definition insufficient half the time is not truly preparing for a repeat of the 1906 earthquake.

The problem of using the median demand is exacerbated by the wide variation in the potential number of fires, fire size, and water demands.[141] As just one example, San Francisco was lucky that there was little to no wind during the Loma Prieta earthquake. Yet as any resident of our City knows, the City often experiences significant wind conditions.

Another problem with the reliability scores is that they ignore where in the FRA a fire is, as well as the size of each FRA. For example, the southeastern portion of the City has several geographically large FRAs.[142] Although water may be able get to the northern part of a particular FRA, the southern part of that FRA may not be as well protected. In addition, the

---

[137] 2018 Westside Options Analysis, at p. 7, https://www.sfwater.org/modules/showdocument.aspx?documentid=117400 ; CS-199, at p. 102, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 .

[138] CS-199, at p. ix, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[139] Scawthorn 2018 memo, at p. 6, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

[140] *Id.*, at p. 5.

[141] *Id.*, at p. 5.

[142] See map of FRAs, attached as Appendix J.

demand represents the water supply need for an entire FRA, and the scores assume that the SFFD "would utilize the Portable Water Supply System (PWSS) or engine relays to distribute the water supply within the FRA to the actual ignition locations."[143] This is an unrealistic assumption, given the City's current inventory of only five old PWSS hose tenders, and the likely demand on fire engines in a major earthquake with a multitude of fires.

The SFPUC is in the process of analyzing potential EFWS demands on a more detailed level, and has shared some of the preliminary results with the Civil Grand Jury. The Civil Grand Jury supports this approach and recommends that the SFPUC continue its efforts to make a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA.

J. Maintenance and Training Issues

1. Maintenance Issues

AWSS assets must be well maintained in order to be operational during an emergency. A 2014 study prepared for the SFPUC by its outside consultants AECOM/AGS, a Joint Venture found "maintenance deficiencies" because routine maintenance plans had not been established for all AWSS assets. Instead, maintenance was being performed on an "as needed" basis.[144]

During our investigation, the Civil Grand Jury learned that the SFPUC has not developed a number of the routine maintenance plans recommended in the 2014 report.[145] The SFPUC assured us that it has done a good job at maintaining AWSS, and disagrees with some of the recommendations in that 2014 report. Nevertheless, the SFPUC has yet to develop routine maintenance plans for some important AWSS assets.

As an example, the report recommended the SFPUC adopt plans to regularly exercise all AWSS system valves.[146] In response, the SFPUC expressed a "goal" to exercise critical valves every two years.[147] It has defined "critical valves" to include only 66 out of the approximately 1,685 valves in the HP AWSS system.[148] SFPUC personnel acknowledge that its current approach is not a "best practice," and that valves should likely be exercised on a regular basis. SFPUC personnel also acknowledge that its definition of what constitutes a "critical" valve requiring more frequent testing is probably too narrow.[149]

---

143 2018 Westside Options Analysis, at p. 37, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

144 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 15-16, 24-26.

145 Information provided by SFPUC.

146 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 25.

147 Information provided by SFPUC.

148 Ibid.

149 Interviews with SFPUC personnel.

In another instance, the 2014 report recommended that all suction connections be cleaned on a regular basis.[150] The SFPUC noted that suction connections were cleaned in 2014, but that the agency had not adopted a routine maintenance plan.[151]

Now that the SFPUC has had time to focus on the condition of the AWSS, the Civil Grand Jury recommends that it utilize "best practices" for the maintenance of AWSS assets, including valves and suction connections, and that the SFPUC, with the help of the SFFD, redefine which valves in the system are "critical," and, therefore, require more attention and priority in its maintenance plans.

2. Coordinated Training and Drills

Another recommendation in CS-199, the 2014 report prepared for the SFPUC by its outside consultant AECOM/AGS, a Joint Venture, was that the SFPUC "prepare an emergency response program and conduct training exercise [sic]."[152] The report also recommended that SFPUC staff be trained on the AWSS system, including "communications, operational strategies," and "emergency response requirements."[153] Both of these recommendations were given "high" priority, and assessed to entail "low" ongoing cost.[154]

In 2015, the SFFD and the SFPUC entered into a Memorandum of Understanding ("MOU") regarding the operation and maintenance of water-supply systems related to fire suppression.[155] In Section C, entitled "Coordinated Emergency Operations Between the SFWD and SFFD", the MOU requires that "All members of the SFWD ... must be trained in the AWSS and the AWSS SCADA system along with the SFFD Water Supply manual."[156] The MOU also specifies that "[t]he SFFD and the SFWD will collaborate for annual training on system operations and appropriate shut-down procedures during and after firefighting operations."[157] The MOU, therefore, requires the SFPUC and the SFFD to coordinate to train all SFWD personnel on the

---

[150] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 15-16, 24-26, 88, 135. There are approximately35 suction connections along the bay that allow engine pumpers to draw by suction from the bay, and a suction line with low-pressure hydrants along Fulton St. that draws from lakes in Golden Gate Park. Some of these suction connections are located on the bottom of the Bay and can be filled with silt or marine organisms that would interfere with water pumping.

[151] Interviews with SFPUC personnel.

[152] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. x, 88.

[153] Ibid.

[154] Ibid.

[155] Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.

[156] *Id.*, at Section C.1.

[157] *Id.*, at Section C.3.

AWSS system and on other available water supply sources to fight fires in emergencies. It also requires coordinated, *annual* training on emergency operation of the system.

In 2017, the SFPUC updated its Emergency Response Plan.[158] A review of the Plan, however, offers little detail on the type of exercise conducted or how often exercises might be conducted in the future.[159] Similarly, although CS-199 identified the need for emergency training and a training exercise, CS-199 did not provide details as to the scope or frequency of any training exercises.

In the past several years the SFFD and SFPUC have taken advantage of many opportunities for joint training concomitant with their joint operation and maintenance of AWSS assets. For example, the two agencies test Pump Stations 1 and 2, on a monthly basis. The agencies also meet after greater-alarm fires to discuss coordination, and how to improve operations in the field. In addition, the SFFD and SFPUC have, on occasion, conducted joint emergency trainings involving earthquake disaster scenarios. In 2018, for example, they engaged in a "tabletop exercise" where high-level staff members were asked to respond to a hypothetical earthquake scenario to test their understanding of the emergency command structure.

The SFPUC anticipates that it will repeat this joint tabletop exercise at least every other year, and that it will conduct larger-scale simulations of post-earthquake emergency response procedures with the SFFD within the next two years. There is no formal document, however, outlining specific joint exercises or drills to be conducted by the two agencies.

In the 1989 Loma Prieta earthquake, human error was cited by some as a reason why AWSS was not available to fight fires in the Marina.[160] A 2011 survey of California fire and water agencies concluded, generally speaking, that "[f]ire and water department liaison is not very good" and that "[e]mergency firefighting water supply is not a focus."[161] Moreover, the report found that fire departments are not "regularly drilled for the very difficult task of moving water from the alternative water sources to the fire scene."[162]

The Civil Grand Jury believes that the City would be well served if the SFPUC and SFFD worked together to design and implement annual "hands-on" drills to make certain that their staff is prepared to use all available resources to fight fires after an earthquake. Accordingly, the Civil Grand Jury recommends that the MOU between the SFPUC and the SFFD be amended to include a more detailed roadmap for emergency response exercises to be held, City-wide,

---

[158] Information provided by SFPUC.

[159] City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

[160] See, e.g., Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992).

[161] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 75. By contrast, both the SFPUC and the SFFD have indicated that they currently enjoy excellent communication.

[162] *Id.*

annually. In addition to tabletop scenarios, these exercises should include hands-on field testing in the operation of AWSS assets and PWSS units.

CONCLUSION

Over one hundred years ago, our City was destroyed by fire following an earthquake. Luckily, our predecessors learned from this catastrophe. They aggressively undertook to design, fund, and quickly build a supplemental emergency water supply system that provided firefighters with multiple options if one or more water sources were compromised – "belt and suspenders." They gave us an excellent emergency water system to protect our wonderful, seismically vulnerable City.

We have, however, long outgrown the protective reach of the system we inherited. Now it is our turn to aggressively implement measures to extend protections to reach all San Francisco neighborhoods. The time to act is now, before it is too late.

FINDINGS

F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.

F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.

F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.

F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.

F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.

F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.

F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.

F8. Redundancy is an important feature of an emergency firefighting water system.

F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.

F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.

F11. The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.

F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.

F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.

RECOMMENDATIONS

R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.

R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.

R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.

R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.

R6. The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.

R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.

R9. By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.

R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the Civil Grand Jury requests responses as follows:

From the following City and County agencies and departments within 60 days:

- Office of the Mayor
    - Findings 4, 5, 6, and 11
    - Recommendations 1, 2, 4, and 8
- General Manager, San Francisco Public Utilities Commission
    - Findings 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13
    - Recommendations 1, 2, 6, 7, 9, and 10
- Chief, San Francisco Fire Department
    - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 13
    - Recommendations 1, 2, 4, 5, 6, 7, and 10
- Office of the City Administrator
    - Findings 6 and 11
    - Recommendations 1, 2 and 8
- Chief Resilience Officer, Office of the City Administrator
    - Findings 6 and 11
    - Recommendations 1, 2 and 8
- Director, San Francisco Department of the Environment
    - Recommendation 6
- Budget and Legislative Analyst Office, Board of Supervisors
    - Findings 6 and 11
    - Recommendation 3

From the Board of Supervisors and other governing bodies within 90 days:

- Board of Supervisors
    - Findings 4, 5, 6 and 11
    - Recommendations 1, 2, 3, 4, 6, 7, and 8
- San Francisco Public Utilities Commission
    - Findings 2, 4, 5, 6, 8, 9, 10, 11, and 12
    - Recommendations 1, 2, 6, 7, 9, and 10
- San Francisco Fire Commission
    - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11
    - Recommendations 1, 2, 4, 5, 6, 9 and 10

GLOSSARY AND TABLE OF ACRONYMS AND ABBREVIATIONS

ATC	Applied Technology Council. A non-profit corporation whose mission is to develop and promote state-of-the-art, user-friendly engineering resources and applications for use in mitigating the effects of natural and other hazards on the built environment, and which prepared reports in 2010 for the City under the CAPSS Project.
AWSS	Auxiliary Water Supply System. An independent emergency firefighting system built after the 1906 earthquake. The AWSS at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations. The AWSS HP pipelines can supply water at pressures up to 300 psi via hydrants with black, red or blue tops, depending upon location.
CAPSS	Community Action Plan for Seismic Safety. According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts.
CCSF	City and County of San Francisco
CDD	City Distribution Division. The division of the SFPUC responsible for maintenance of both the MWSS and the AWSS.
DWSS	Domestic Water Supply System, also referred to as the Municipal Water Supply System, MWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS (DWSS) is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
ERDIP	Earthquake Resistant Ductile Iron Pipe. A modern type of pipe that is believed to be earthquake resistant and that has been subjected to several major earthquakes in Japan without any observed failures.
EFWS	Emergency Firefighting Water System. All emergency sources of water and the means for delivering them. Includes HP AWSS pipelines, cisterns, PWSS and fireboats.
ESER	Earthquake Safety and Emergency Response. ESER bonds are generally issued every five to seven years to address to fund repairs and improvements to infrastructure that allow the City to respond more quickly and effectively to a major earthquake or other disaster.

FRA	Fire Response Area. The SFFD divides the City into 46 areas for initial alarm response, referred to as Fire Response Areas or FRAs.
HP	High-pressure
LOS	Level of Service
MOU	A Memorandum of Understanding between the SFPUC and the SFFD Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.
MWSS	Municipal Water Supply System, also referred to as the Domestic Water Supply System, DWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
PEER	Pacific Earthquake Engineering Research Center
PSI	Pounds per square inch
PWSS	Portable Water Supply System. A mobile above-ground large (five-inch) diameter hose system transported on trucks (hose tenders). A hose tender truck can carry approximately 5000 feet of five-inch hose. A more thorough description is provided at pages 23-26. The PWSS is not to be confused with the flexible water supply system, an idea for 12-inch diameter hoses that was abandoned as impractical.
SCADA	Supervisory Control and Data Acquisition. A computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
SFDPW	San Francisco Department of Public Works
SFFC	San Francisco Fire Commission
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
USGS	United States Geological Survey
WSIP	Water System Improvement Program. The WSIP is a $4.8 billion dollar, multi-year program to upgrade the SFPUC's regional and local water systems. The WSIP, which is over 96% complete, is one of the largest water infrastructure

programs in the nation and the largest infrastructure program ever undertaken by the City.

APPENDICES

A. Table of Findings and Recommendations
B. Table of Findings with Required Responses
C. Table of Recommendations with Required Responses
D. List of Reports Specifically Focusing on the City's AWSS or PWSS
E. List of Additional Reports Reviewed
F. USGS, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf
G. USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf
H. Map of Existing EFWS, with HP AWSS, Cisterns and other Assets
I. Map of Existing HP AWSS system
J. Map of SFFD Fire Response Areas
K. Abstract (page 2) from Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf
L. Analysis by the Ballot Simplification Committee of 1986 Proposition A.
M. San Francisco Fire Commission Resolution 2010-01, dated January 14, 2010, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf
N. SFPUC 2017 FAQ, https://sfwater.org/modules/showdocument.aspx?documentid=11507 printed March 6, 2019
O. SFPUC EFWS 2010 and 2014 ESER bond project status as of February 26, 2019
P. SFPUC Candidate EFWS Project list dated May 8, 2019
Q. Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990
R. Figure 5-1, *Preferred Alternative Planning Schedule*, from CS-199, at p. 71, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

APPENDIX A
TABLE OF FINDINGS AND RECOMMENDATIONS

Findings	Recommendations
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco. F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake. F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake. F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake. F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake. R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034. R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

Findings	Recommendations
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced seismically safe emergency water supply can be developed in those areas.	R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.
F8. Redundancy is an important feature of an emergency firefighting water system. F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

Findings	Recommendations
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

APPENDIX B
TABLE OF FINDINGS WITH REQUIRED RESPONSES

Findings	Required Responses
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	• Chief, San Francisco Fire Department • San Francisco Fire Commission • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Chief, San Francisco Fire Department • San Francisco Fire Commission
F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	• Chief, San Francisco Fire Department • San Francisco Fire Commission
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F8. Redundancy is an important feature of an emergency firefighting water system.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	• General Manager, San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department

APPENDIX C
TABLE OF RECOMMENDATIONS WITH REQUIRED RESPONSES

Recommendations	Required Responses
R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short-term and the long-term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	• Board of Supervisors • Budget and Legislative Analyst Office, Board of Supervisors

Recommendations	Required Responses
R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	• Office of the Mayor • Board of Supervisors • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Director, San Francisco Department of the Environment
R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above the median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department
R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034	• Office of the Mayor • Board of Supervisors • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator

Recommendations	Required Responses
R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

APPENDIX D
List of Reports Specifically Focusing On the City's AWSS or PWSS

2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf

AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report) (February 2014) ("CS-199"), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, prepared for SFPUC (February 2014), https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907

AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015) ("CS-229"), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246

AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report (January 5, 2018) ("2018 Westside Options Analysis"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found online at http://www.sfearthquakesafety.org/eser-reports.html

Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7

Metcalf & Eddy / AECOM, Auxiliary Water Supply System (AWSS) Study, prepared for Capital Planning Committee, City and County of San Francisco (2009) ("Metcalf & Eddy"), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00

San Francisco Department of Public Works, Auxiliary Water Supply System (AWSS) Pipeline Assessment, Earthquake Safety and Emergency Response Bond 2010, prepared for SFPUC (May 11, 2017), https://sfpuc.sharefile.com/share/view/684778cd4b46406e

Scawthorn, C., January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis", (Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC

APPENDIX E
List of Additional Reports Reviewed

Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010)("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf

Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety, prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project (2010), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517

Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018)

City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019

Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf

Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf

Kearns, F. and Moritz, M., How fierce fall and winter winds help fuel California fires, *The Conversation* (16 November, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985

Li, W., Wang, D., and Zhao, K., Research on Urban Post-earthquake Fire, presented at Sixth China-Japan-U.S. Trilateral Symposium on Lifeline Earthquake Engineering (2013) https://ascelibrary.org/doi/10.1061/9780784413234.008

Moritz, M., *California Needs To Rethink Urban Fire Risk, Starting with Where It Builds Houses*, in The Conversation (December 13, 2017), https://theconversation.com/california-needs-to-rethink-urban-fire-risk-starting-with-where-it-builds-houses-88825

O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996)

San Francisco Fire Department Emergency Operations Plan

San Francisco Fire Department Water Supplies Manual (2008), http://ufsw.org/pdfs/water_supplies_manual.pdf

Scawthorn, C., Coordinated Planning and Preparedness for Fire Following Major Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2013), https://ssc.ca.gov/forms_pubs/webpeer-2013-23-scawthorn.pdf

Scawthorn, C., Water Supply In Regards to Fire Following Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf

Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf

Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf or for a copy, click here.

Scawthorn, C., Fire Following Earthquake Aspects of the Southern San Andreas Fault M_W 7.8 Earthquake Scenario. *Earthquake Spectra* 27 (2), 419-441 (2011), http://www.sparisk.com/pubs/Scawthorn-2011-ShakeOut-FFE.pdf

Scawthorn, C., *Fire Following Earthquake, Supplemental Study for the ShakeOut Scenario.* The ShakeOut Scenario: U.S. Geological Survey Open File Report 2008-1150, California Geological Survey Preliminary Report 2, version 1.0, U.S. Geological Survey Circular 1324, California Geological Survey Special Report 207 version 1.0. U. S. Geological Survey and California Geological Survey, Pasadena (2008), Scawthorn-2008-ShakeOut-FFE

Scawthorn, C., Fire Following the M_w 7.0 HayWired Earthquake Scenario, in Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Engineering Implications*. Scientific Investigations Report 2017–5013–I–Q. Reston, VA: United States Geological Survey, ch. P, pp. 367-400 (2018), at https://doi.org/10.3133/sir20175013 and www.sparisk.com/pubs/HayWired-2018-vol2.pdf

Scawthorn, C., O'Rourke, T. D. & Blackburn, F. T., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*. Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf.

Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

U.S. Geological Survey, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf

U.S. Geological Survey, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf

Appendix F

USGS science for a changing world — SCEC AN NSF+USGS CENTER — CGS CALIFORNIA GEOLOGICAL SURVEY — CEA CALIFORNIA EARTHQUAKE AUTHORITY THE STRENGTH TO REBUILD

UCERF3: A New Earthquake Forecast for California's Complex Fault System

With innovations, fresh data, and lessons learned from recent earthquakes, scientists have developed a new earthquake forecast model for California, a region under constant threat from potentially damaging events. The new model, referred to as the third Uniform California Earthquake Rupture Forecast, or "UCERF3" (http://www.WGCEP.org/UCERF3), provides authoritative estimates of the magnitude, location, and likelihood of earthquake fault rupture throughout the state. Overall the results confirm previous findings, but with some significant changes because of model improvements. For example, compared to the previous forecast (UCERF2), the likelihood of moderate-sized earthquakes (magnitude 6.5 to 7.5) is lower, whereas that of larger events is higher. This is because of the inclusion of multifault ruptures, where earthquakes are no longer confined to separate, individual faults, but can occasionally rupture multiple faults simultaneously. The public-safety implications of this and other model improvements depend on several factors, including site location and type of structure (for example, family dwelling compared to a long-span bridge). Building codes, earthquake insurance products, emergency plans, and other risk-mitigation efforts will be updated accordingly. This model also serves as a reminder that damaging earthquakes are inevitable for California. Fortunately, there are many simple steps residents can take to protect lives and property.

What is UCERF3?

California is sandwiched between the Pacific and North American tectonic plates, with the former migrating northwest about two inches per year compared to the latter. The plate boundary is far from smooth, reflecting more of a fragmented zone locked in a tectonic battle over which areas will give way, producing some of the steepest mountain ranges in the world. The sliding between plates is also not steady, but rather plays out in fits and starts with periods of rest interrupted by sudden slip along cracks in the Earth. These "fault ruptures" in turn cause the ground to shake, much like the ripples that radiate from a pebble tossed in a pond, and it is this shaking that causes the most damage in earthquakes.

Two kinds of scientific models are used to help safeguard against earthquake losses: an Earthquake Rupture Forecast, which tells us where and when the Earth might slip along the state's many faults, and a Ground Motion Prediction model, which estimates the subsequent shaking given one of the fault ruptures. UCERF3 is the first type of model, representing the latest earthquake-rupture forecast for California. It was developed and reviewed by dozens of leading scientific experts from the fields of seismology, geology, geodesy, paleoseismology, earthquake physics, and earthquake engineering. As such, it represents the best available science with respect to authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes throughout the state (further background on these models, especially with respect to ingredients, can be found in U.S. Geological Survey Fact Sheet 2008–3027, http://pubs.usgs.gov/fs/2008/3027/).

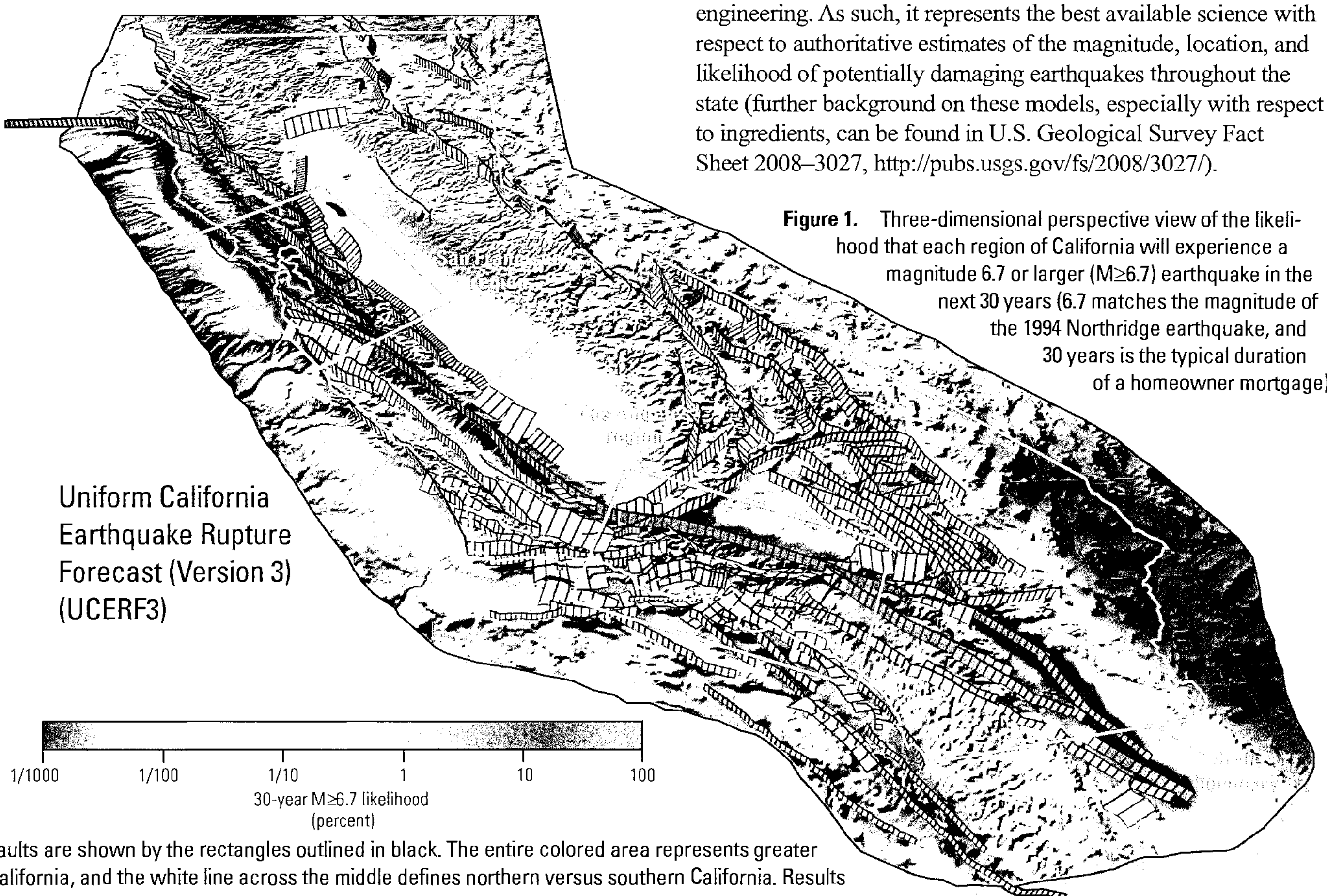


Figure 1. Three-dimensional perspective view of the likelihood that each region of California will experience a magnitude 6.7 or larger (M≥6.7) earthquake in the next 30 years (6.7 matches the magnitude of the 1994 Northridge earthquake, and 30 years is the typical duration of a homeowner mortgage).

Faults are shown by the rectangles outlined in black. The entire colored area represents greater California, and the white line across the middle defines northern versus southern California. Results do not include earthquakes on the Cascadia Subduction Zone, a 750-mile offshore fault that extends about 150 miles into California from Oregon and Washington to the north.

U.S. Department of the Interior
U.S. Geological Survey

Printed on recycled paper

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20153009

Fact Sheet 2015–3009
March 2015

Fault Model Evolution

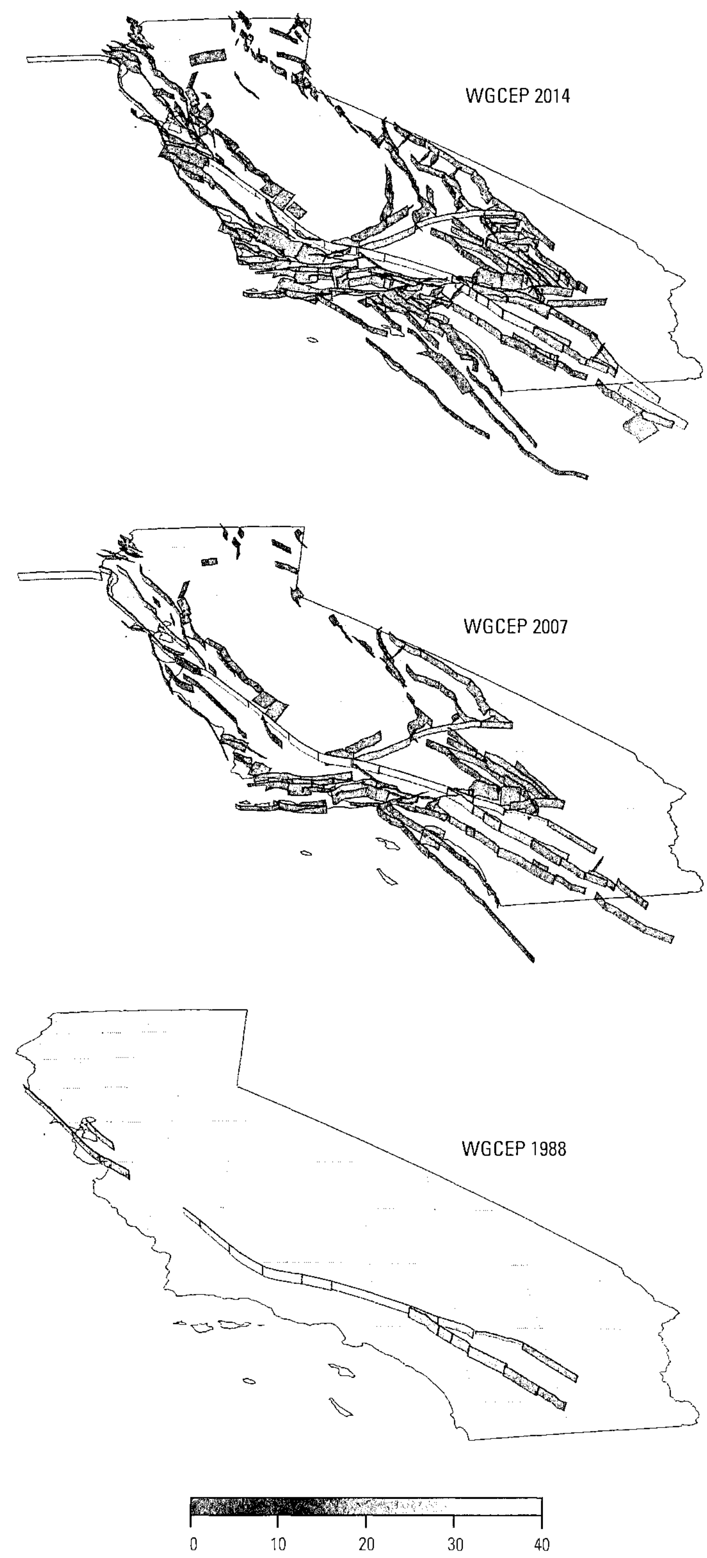


Figure 2. Changes with time of the inventory of faults used in California earthquake forecast models (WGCEP, Working Group on California Earthquake Probabilities).

Why a New Earthquake Forecast Model?

All scientific models, including earthquake rupture forecasts, are an approximation of the physical system they represent, in the same way that "the map is not the actual territory" (Korzbski, 1931). UCERF3 represents the latest model from the Working Group on California Earthquake Probabilities (WGCEP) (WGCEP, 2014), which also released forecasts in 1988, 1990, 1995, 2003, and 2007. This historical progression of models reflects increasingly accurate, detailed, and sophisticated representations of a particularly complex natural system.

A puzzling feature of previous models has been a forecasted rate of moderate-sized earthquakes (between magnitude 6.5 and 7.0) that is up to a factor of two higher than that observed historically. The first discovery of this discrepancy, by the 1995 WGCEP, was particularly disturbing in that one such event, the magnitude 6.7 1994 Northridge earthquake, had just surprised many as the costliest earthquake in U.S. history. In fact, the prospect of such events becoming more frequent contributed to an ensuing homeowner-insurance-availability crisis, as most insurance providers opted to pull out of the market altogether, rather than comply with a state law requiring they offer an earthquake option with each policy. This insurance availability crisis was ultimately solved in 1996 with the legislative creation of the California Earthquake Authority (http://www.earthquakeauthority.com), which has since become the largest earthquake insurance provider in the state. However, the discrepancy between the forecast rate and the observed rate at moderate magnitudes has remained through the most recent previous study (WGCEP, 2007), and scientists have hotly debated whether this is real or a result of some model limitation.

Recent earthquakes have fortunately provided clues. For example, the Northridge earthquake occurred on a previously unrecognized fault, which motivated scientists to search for other faults and quantify those that might be capable of producing damaging earthquakes. The effort has paid off. Whereas the 1988 WGCEP considered only 16 different faults, albeit the main ones, by the time of the WGCEP 2007 effort there were about 200. With UCERF3, there are now more than 350 fault sections in the model, thanks in part to using space-based geodesy where geologic data are limited. This historical progression is shown in the fault model evolution figure at left.

Another clue with respect to the moderate-magnitude rate discrepancy is that many recent earthquakes have plowed past previously inferred fault-rupture boundaries. That is, past models have generally assumed that earthquakes are either confined to separate faults, or that long faults like the San Andreas can be divided into different segments that only rupture separately. However, all three of the most-recent, largest earthquakes in California ruptured right past such boundaries, jumping from one fault to another as multifault ruptures. These were the 1992 magnitude 7.3 Landers, the 1999 magnitude 7.2 Hector Mine, and the 2010 magnitude 7.2 El Mayor–Cucapah earthquakes. The 2011 magnitude 9.0 Tohoku, Japan earthquake also violated previously defined fault-segment boundaries, resulting in a much larger fault-rupture area and magnitude than expected, and contributing to the deadly tsunami and Fukushima nuclear disaster.

Given these observations, the possibility of multifault ruptures clearly needed to be considered in our new model. In fact, as the inventory of California faults has grown over the years, it

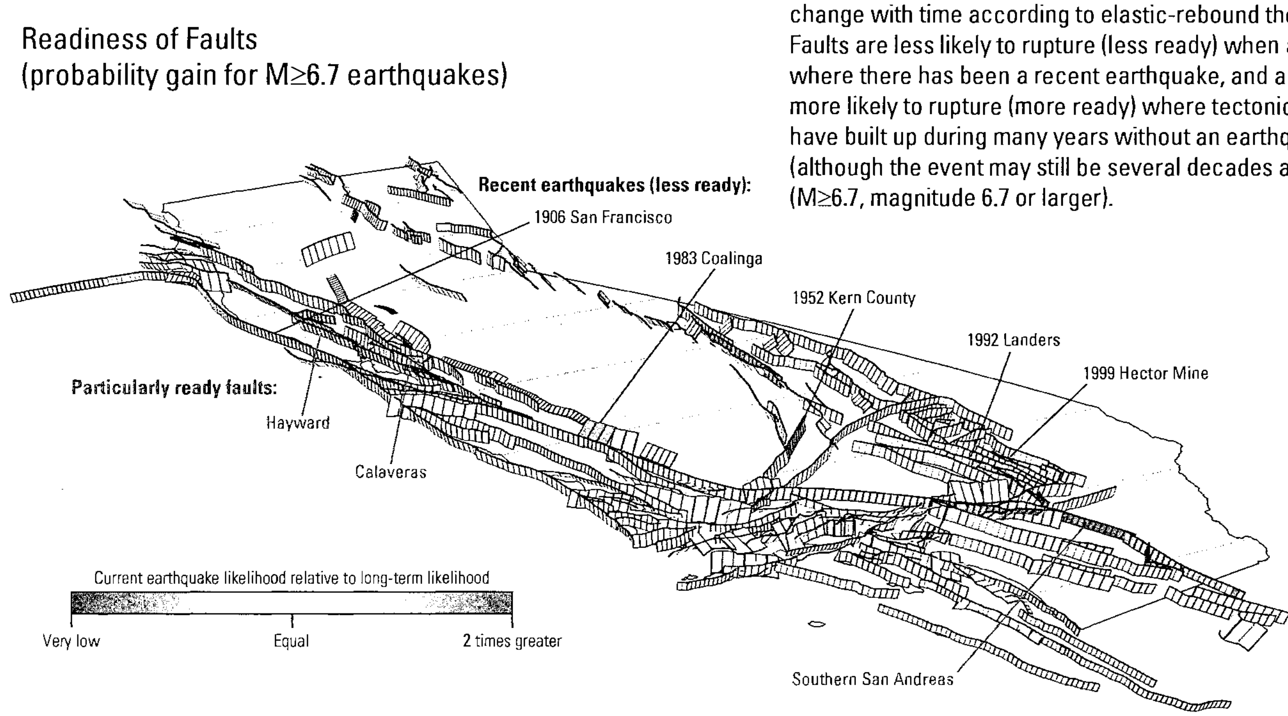


Figure 3. California earthquake likelihood in UCERF3 incorporates the concept that earthquake probabilities change with time according to elastic-rebound theory. Faults are less likely to rupture (less ready) when and where there has been a recent earthquake, and are more likely to rupture (more ready) where tectonic forces have built up during many years without an earthquake (although the event may still be several decades away) (M≥6.7, magnitude 6.7 or larger).

has become increasingly apparent that we are not dealing with a few well-separate faults, but with a vast interconnected fault system. In fact, it has become difficult to identify where some faults end and others begin, implying many more opportunities for multifault ruptures. As a consequence, UCERF3 now considers more than 250,000 different fault-based earthquakes, including multifault ruptures, whereas UCERF2 had about 10,000, and previous models had far fewer. Because we still lack a complete inventory of faults, UCERF3 (and UCERF2 before it) also includes the possibility of earthquakes on unrecognized faults elsewhere in the region.

Solving for the rate of all possible ruptures in the interconnected fault system represented a significant challenge. The UCERF3 methodological breakthrough, referred to as the "grand inversion," allowed us to not only solve for the rate of each earthquake rupture, but to also draw upon a broader range of observations in doing so. For example, the previous rate discrepancy at moderate-magnitudes was turned into part of the solution. That is, because the total plate-tectonic deformation is generally well known, any increase in the rate of larger, multifault ruptures must come with a consequent reduction in rates at lower magnitudes. The grand inversion manages the overall plate-tectonic, fault-system budget mathematically, adding whatever multifault ruptures are needed to eliminate the rate discrepancy at moderate magnitudes. So, not only does UCERF3 include the types of multifault ruptures seen in nature, but doing so has also eliminated the overprediction of moderate-sized events, implying the latter was simply a manifestation of the isolation and segmentation of faults in the previous models.

UCERF3 also includes the notion of fault "readiness," where earthquake likelihoods go down on faults that have recently ruptured, and build back up with time as tectonic stresses reaccumulate. Although this concept, known formally as Reid's elastic rebound theory (Reid, 1911), has been around for more than a century, applying it in a model that includes multifault ruptures also proved challenging. A new methodology was therefore developed, which also relaxes the requirement that the date-of-last event be known where applied. That is, we may not know when the most recent event occurred on many California faults, but we do know that it had to have been prior to 1875 (the year when reliable recordkeeping began). Being able to account for this "historic open interval" for events that precede 1875 allowed us to quantify fault readiness throughout the entire fault system (fig. 3), rather than being limited to only a subset of faults as in previous studies.

There are many uncertainties in both the data and scientific theories that go into UCERF3, and alternative values for each element can lead to a different forecast. Consequently, UCERF3 is not a single model, but rather a collection of 5,760 different viable models. The results presented in the next section represent an average of these forecasts. Calculating grand-inversion results for all the models required the use of super computers, as they would have taken more than 8 years on a single desktop computer.

What Are the Results, and How Do They Differ from Previous Estimates?

UCERF3 results for various regions and faults of interest are shown in the figures and tables here. How have expected earthquake rates changed from the previous model? Overall, the results confirm earlier findings (California is earthquake country), but with some important refinements in certain areas. Considering the entire region, the average time between magnitude 6.7 and larger earthquakes has gone from 1 every 4.8 years in UCERF2, to 1 about every 6.3 years in UCERF3, representing a 30 percent decrease in the new forecasted

Table 1. Average time between earthquakes in the various regions together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014). Values listed in parentheses indicate the factor by which the rates and likelihoods have increased, or decreased, since the previous model (UCERF2). "Readiness" indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes (see text). These values include aftershocks. It is important to note that actual repeat times will exhibit a high degree of variability, and will almost never exactly equal the average listed here.

Greater California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.12	(0.7)	100%	(1.0)	1.0
6	1.2	(0.9)	100%	(1.0)	1.0
6.7	6.3	(1.3)	>99%	(1.0)	1.0
7	13	(1.3)	93%	(1.0)	1.0
7.5	52	(1.0)	48%	(1.0)	1.1
8	494	(0.8)	7%	(1.5)	1.2

Southern California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.3	(0.9)	100%	(1.0)	1.0
6.7	12	(1.5)	93%	(1.0)	1.0
7	25	(1.4)	75%	(0.9)	1.1
7.5	87	(1.2)	36%	(0.9)	1.2
8	522	(0.4)	7%	(2.5)	1.3

Northern California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.4	(0.9)	100%	(1.0)	1.0
6.7	12	(1.2)	95%	(1.0)	1.0
7	25	(1.2)	76%	(1.0)	1.1
7.5	92	(0.9)	28%	(1.1)	1.0
8	645	(0.8)	5%	(1.4)	1.1

San Francisco region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.3	(0.7)	100%	(1.0)	1.0
6	8.9	(1.0)	98%	(1.0)	1.0
6.7	29	(1.1)	72%	(1.1)	1.1
7	48	(0.9)	51%	(1.3)	1.1
7.5	124	(0.7)	20%	(1.6)	0.9
8	825	(0.7)	4%	(1.9)	1.0

Los Angeles region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.4	(0.6)	100%	(1.0)	1.0
6	10	(1.1)	96%	(1.0)	1.0
6.7	40	(2.1)	60%	(0.8)	1.1
7	61	(2.0)	46%	(0.7)	1.2
7.5	109	(1.3)	31%	(0.9)	1.3
8	532	(0.4)	7%	(2.5)	1.3

rate (and note that most of these events occur in remote areas of the state). For magnitude 8 and larger, on the other hand, the rate has increased by 20 percent in UCERF3, with an expected repeat time of 494 years for UCERF3, down from 1 every 617 years in UCERF2. These changes are a direct and expected manifestation of including multifault ruptures in UCERF3. A more careful analysis of historical seismicity has also produced an increased rate for magnitude 5 and greater earthquakes, going from about 5.8 per year in UCERF2 to 8.3 per year in UCERF3. All of these trends are similar to those seen in various subregions of the state, with differences being slightly more dramatic for the Los Angeles area because that region has a large number of faults that can now host multifault ruptures.

Results are also expressed in terms of the likelihood of experiencing one or more earthquakes in the next 30 years, the duration of a typical home mortgage, and these values also take fault readiness into consideration (how long it has been since the most recent event). As in UCERF2, the likelihood for magnitude 6.7 and larger earthquakes somewhere in the entire region remains near certainty (greater than 99 percent). The likelihood is 7 percent for magnitude 8 and greater, a 50 percent increase over UCERF2, resulting from both the inclusion of multifault ruptures and the particular readiness of some large faults.

One particularly ready fault is the Southern San Andreas, which contributes to its continued status of being the most likely to host a large earthquake. Specifically, it has a 19 percent chance of having one or more events larger than magnitude 6.7 in the next 30 years near Mojave, Calif. The comparably low values for the Northern San Andreas, such as 6.4 percent near San Francisco, are partly because of the relatively recent 1906 earthquake on that fault. In fact, probabilities on two other Bay Area faults, the Hayward–Rodgers Creek and the Calaveras, currently rival or exceed those on the Northern San Andreas, in part because they are both relatively ready.

Compared to the previous model, UCERF2, the San Jacinto fault has a three-fold decrease in the likelihood of magnitude 6.7 or larger earthquakes. Much of this decrease is because of the inclusion of more multifault ruptures, as indicated by the factor of 57 increase in the likelihood of magnitude 8 and larger earthquakes. In other words, the fault has traded some moderate-sized events for rare larger ones.

The Calveras fault, on the other hand, has a three-fold increase in the likelihood of magnitude 6.7 or larger earthquakes. In UCERF2 most Calaveras events were well below magnitude 6.7, so the inclusion of multifault ruptures in UCERF3 has increased the frequency of earthquakes above magnitude 6.7.

We have only touched on a few of the more important changes between UCERF2 and UCERF3, and have highlighted only some of the influential factors. Many more are currently understood, and scientists will be further analyzing results and testing assumptions for years to come.

So what do these changes imply with respect to seismic hazard, the likelihood of ground shaking, as well as for seismic risk, the threat to the built environment with respect to fatalities and economic losses? The answer turns out to be entirely dependent on what you are concerned about. For example, increasing the likelihood of large multifault earthquakes, which consequently reduces the likelihood of moderate-sized events, may increase the risk to tall buildings or large bridges, but actually lower the risk to residential homes.

As a consequence, it is difficult to make generalizations about the hazard or risk implications of UCERF3 without first specifying both asset types and their locations. Conclusions will vary depending on whether you are designing a single family dwelling in Sacramento, retrofitting the San Francisco–Oakland Bay Bridge, considering the location of a nuclear power plant, laying pipeline across the San Andreas Fault, or considering aggregate losses over a large insurance portfolio. The practical implications will need to be considered on a case-by-case basis.

What Next?

UCERF3 can now be used to evaluate seismic hazard and risk in California. In fact, it has already been used for the 2014 update of the U.S. Geological Survey National Seismic Hazard Maps (http://earthquake.usgs.gov/hazards/), which in turn are used in building codes. The California Earthquake Authority, which is required by law to use the best available science, will use UCERF3 to evaluate insurance premiums charged to customers, as well as their own level of reinsurance. UCERF3 will be used in many other risk mitigation

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

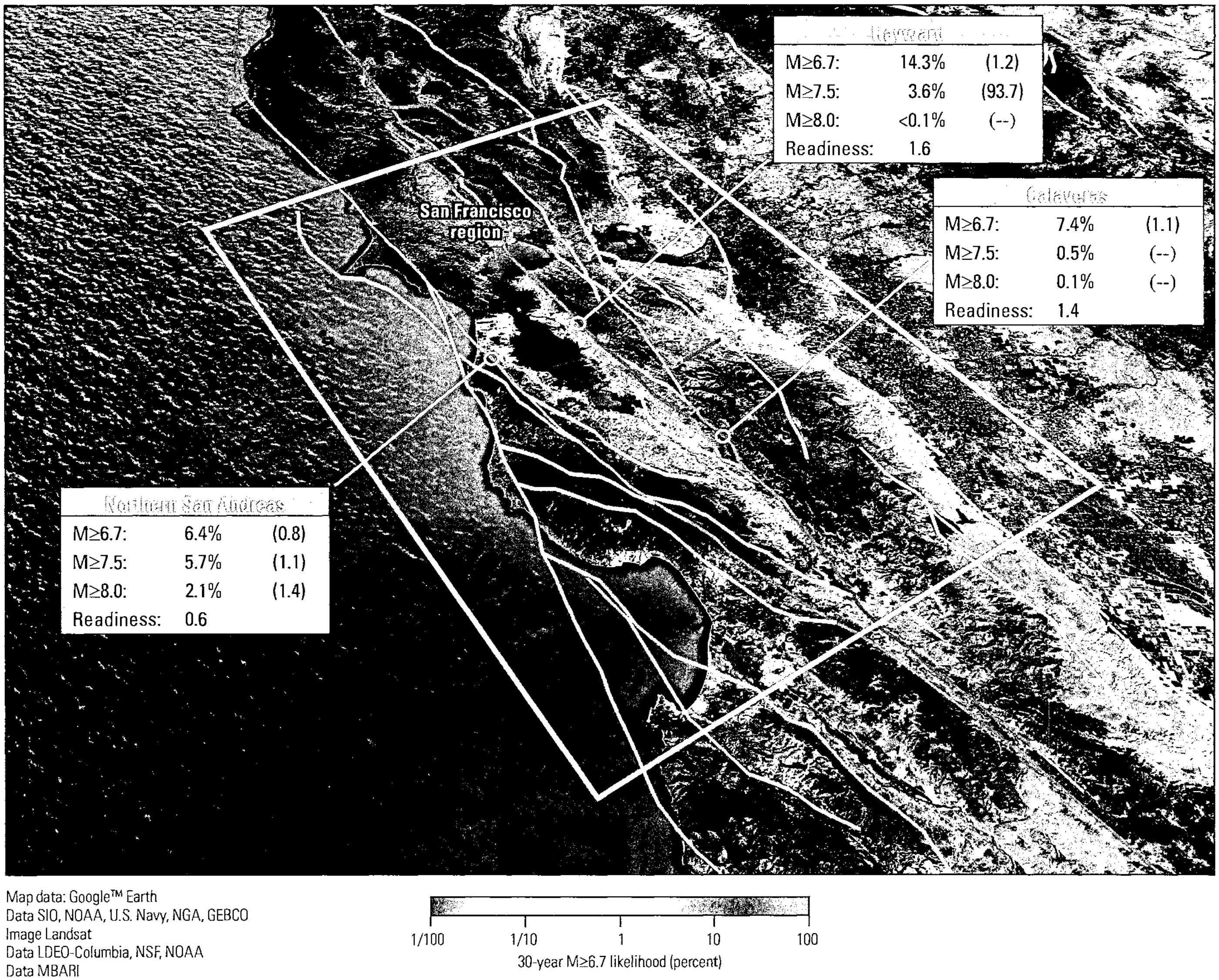
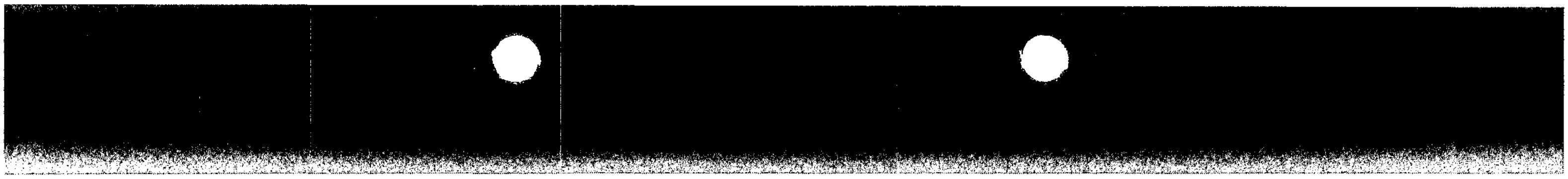


Figure 4. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near San Francisco, Calif.

efforts in the years to come, including engineering design of buildings and lifelines, loss estimation for catastrophic bonds and other risk-linked securities, and emergency preparedness, all of which have the ultimate goal of increasing public safety and community resilience.

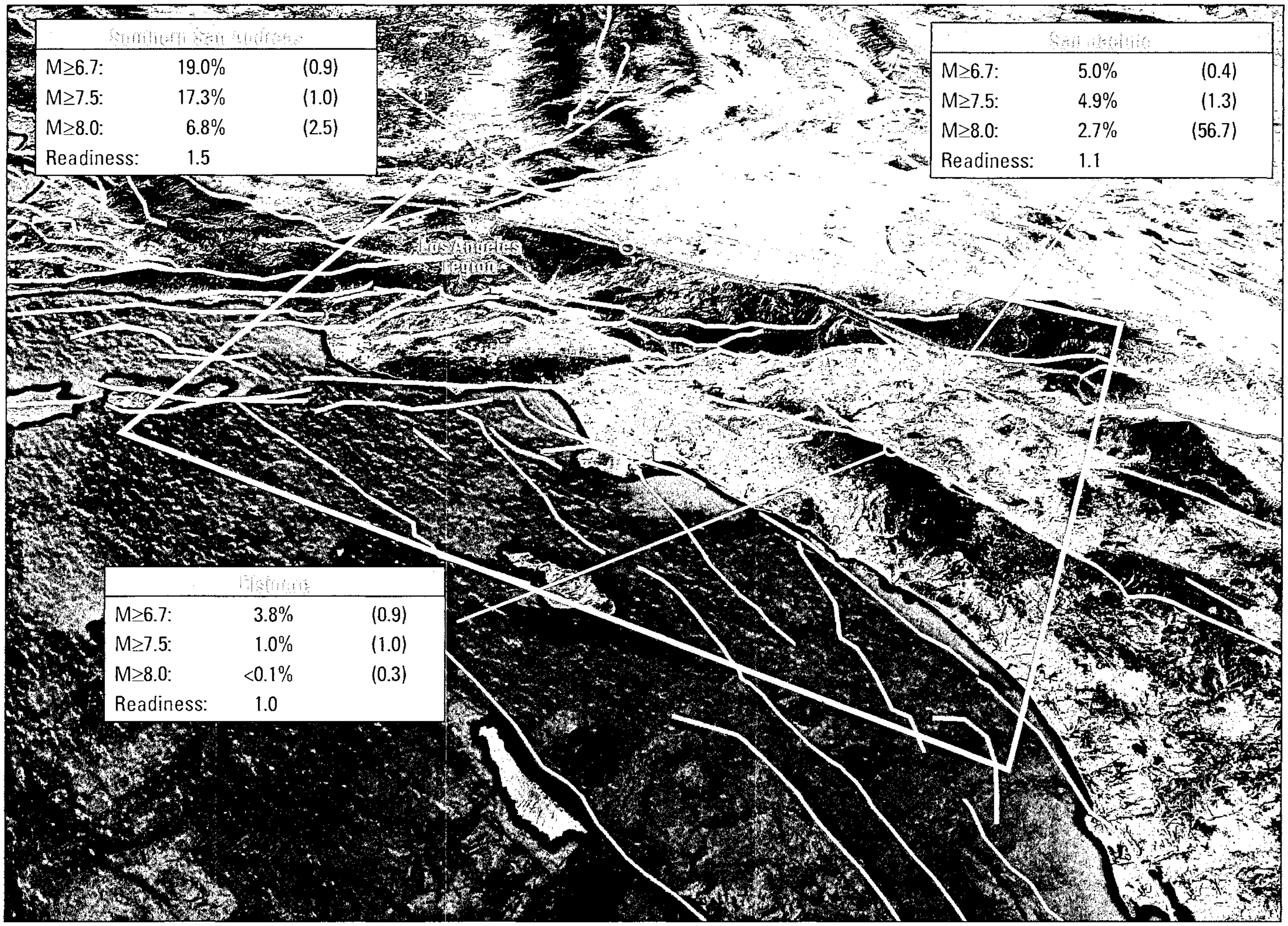
UCERF3 should also serve as a reminder that California is earthquake country, and residents should always be prepared. Simple safeguards include practicing "drop, cover, and hold on," securing items in your home and workplace that could fall during an earthquake, and storing seven-days worth of food and water. Homeowners can also consider structural retrofits, such as bolting the house to its foundation, as well as earthquake insurance options. For further guidance on how to prepare for, survive, and recover after big earthquakes, follow the Seven Steps to Earthquake Safety (http://www.earthquakecountry.org/sevensteps).

Although UCERF3 is a clear improvement over the previous model (UCERF2), it is still an approximation of the natural system. For example, it does not model the earthquake-triggering process that produces aftershocks, even though we know such events can be large and damaging. Through the National Earthquake Hazard Reduction Program (http://www.nehrp.gov), the U.S. Geological Survey and its partners will continue to conduct research aimed at improving our understanding of fault behavior and estimates of earthquake hazard in the future.



Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]



Map data: Google™ Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Data LDEO-Columbia, NSF, NOAA
Data MBARI

1/100 1/10 1 10 100
30-year M≥6.7 likelihood (percent)

Figure 5. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near Los Angeles, Calif.

References

Korzybski, A. 1931, A non-Aristotelian System and its necessity for rigour in mathematics and physics: presention at the American Mathematical Society, December 28, 1931, New Orleans, Louisiana, meeting of the American Association for the Advancement of Science. Reprinted in Science and Sanity, 1933, p. 747–61.

Reid, H.F., 1911, The elastic-rebound theory of earthquakes: University of California Publications, Bulletin of the Department of Geological Sciences v. 6, p. 413–444.

Working Group on California Earthquake Probabilities, 2007, Published as: Field, E.H., Dawson, T.E., Felzer, K.R., Frankel, A.D., Gupta, V., Jordan, T.H., Parsons, T., Petersen, M.D., Stein, R.S. Weldon, II, R.J., and Wills, C.J., 2009, Uniform California earthquake rupture forecast, Version 2 (UCERF 2): Bulletin of the Seismological Society of America, v. 99, p. 2053–2107, doi:10.1785/0120080049.

Working Group on California Earthquake Probabilities, in press, Published as: Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R. Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C. Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J. II, , and Zeng, Y., 2015, Long-term, time-dependent probabilities for the third uniform California earthquake rupture forecast (UCERF3), Bulletin of the Seismological Society of America.

—*Authors: Edward H. Field and members of the 2014 WGCEP*

Cooperating organizations:
Southern California Earthquake Center (SCEC)
California Geological Survey (CGS)
California Earthquake Authority
U.S. Geological Survey

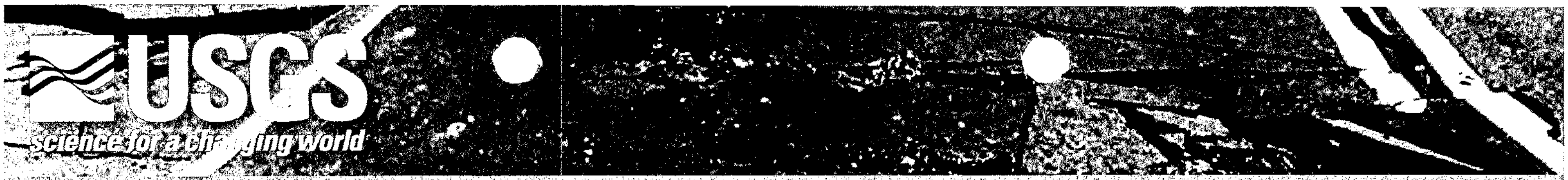
Additional Resources:

For general earthquake information contact:
1-888-ASK-USGS (1-888-275-8747)
http://earthquake.usgs.gov/
http://ask.usgs.gov
or
SCEC Education and Outreach: 213-740-3262

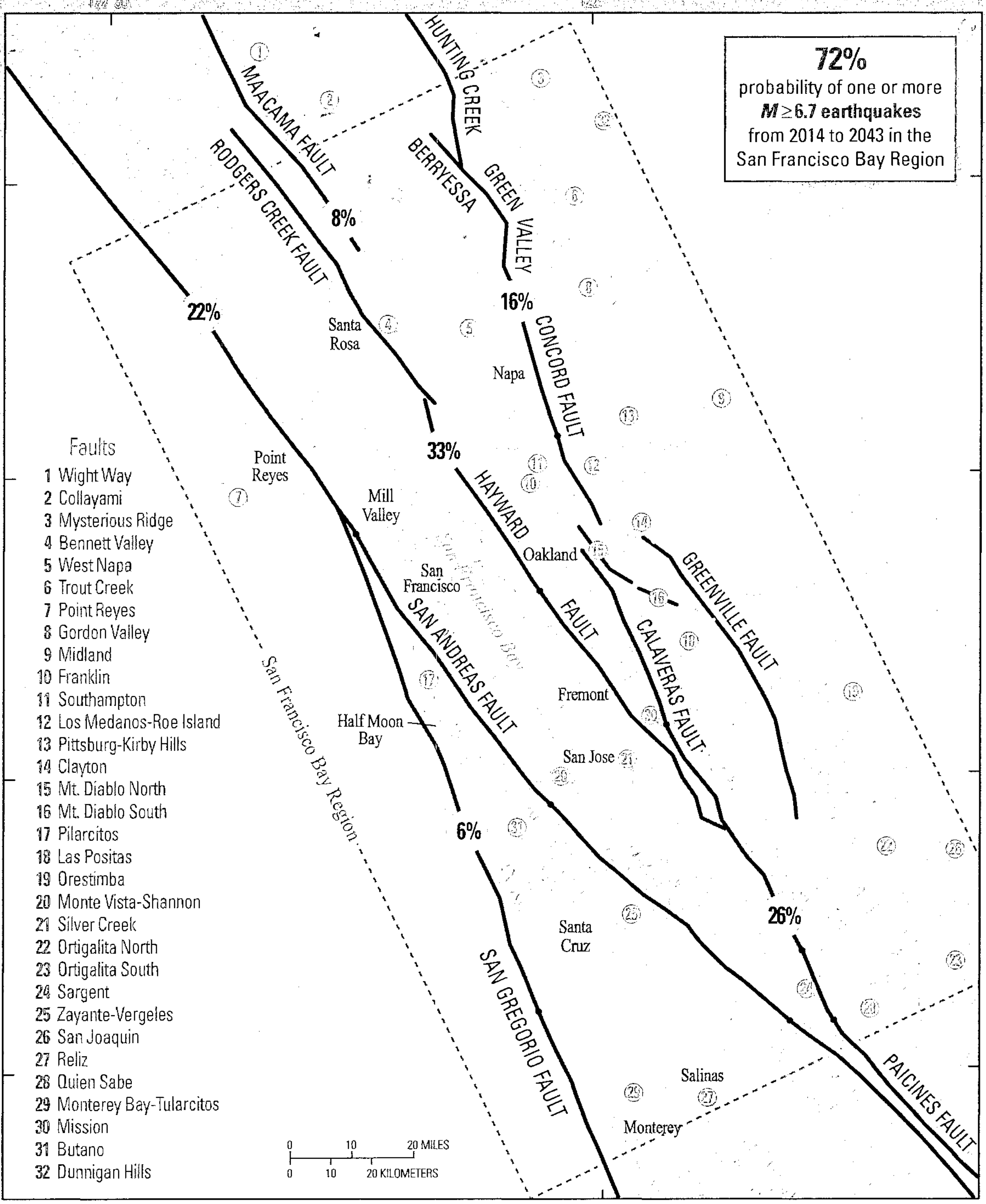
For UCERF3 information see:
http://www.WGCEP.org/UCERF3

For technical questions contact:
Edward (Ned) Field: field@usgs.gov

Appendix G



Earthquake Outlook for the San Francisco Bay Region 2014–2043



EXPLANATION

Major plate boundary faults

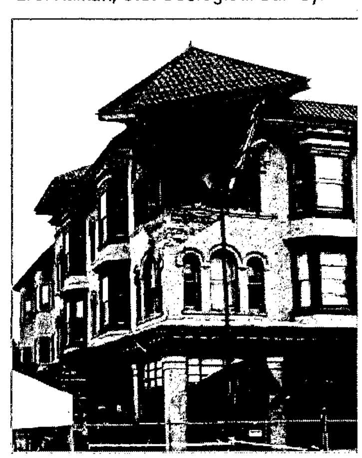
③ Lesser-known smaller faults

Urban areas

Map of known active faults in the San Francisco Bay region. The 72 percent probability of a magnitude 6.7 or greater earthquake includes the well-known major plate-boundary faults, lesser-known faults, and unknown faults. The percentage shown within each colored circle is the probability that a magnitude 6.7 or greater earthquake will occur somewhere on that fault system by the year 2043. The probability that a magnitude 6.7 or greater earthquake will involve one of the lesser-known faults is 13 percent.

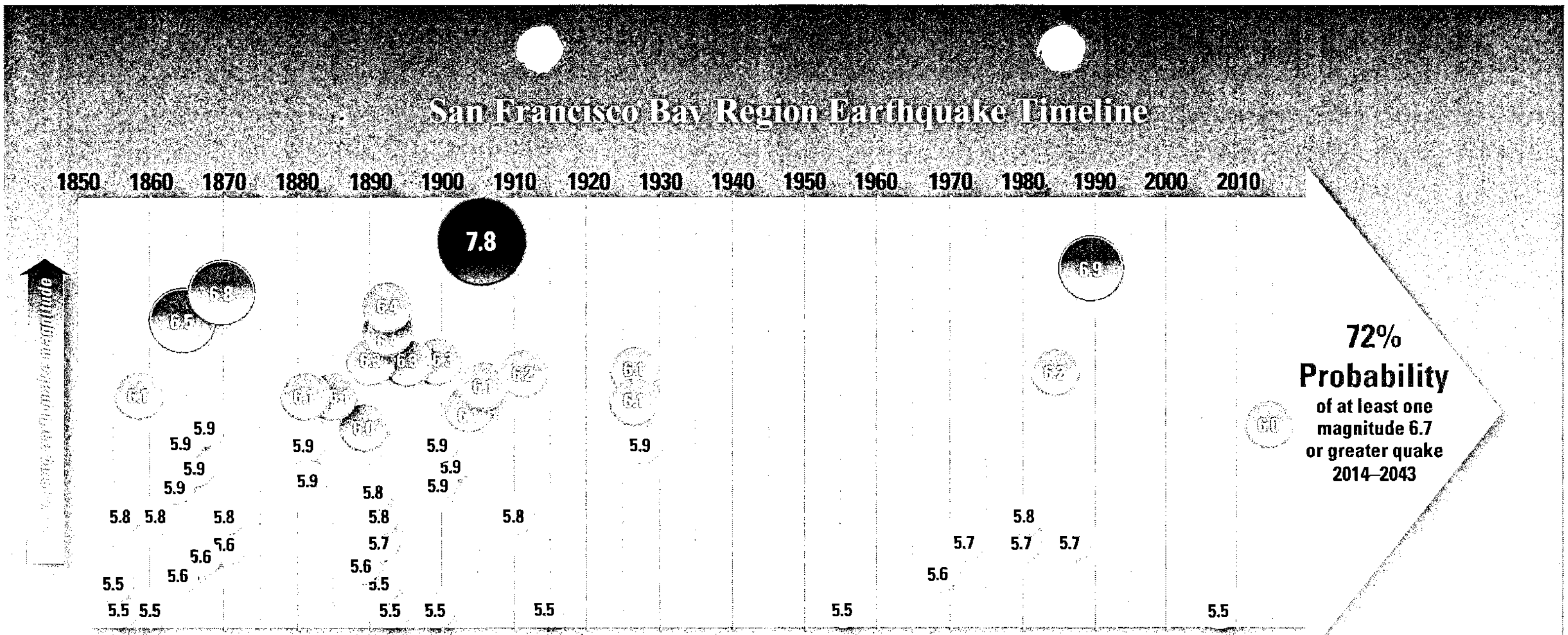
Using information from recent earthquakes, improved mapping of active faults, and a new model for estimating earthquake probabilities, the 2014 Working Group on California Earthquake Probabilities updated the 30-year earthquake forecast for California. They concluded that there is a 72 percent probability (or likelihood) of at least one earthquake of magnitude 6.7 or greater striking somewhere in the San Francisco Bay region before 2043. Earthquakes this large are capable of causing widespread damage; therefore, communities in the region should take simple steps to help reduce injuries, damage, and disruption, as well as accelerate recovery from these earthquakes.

Building damaged in 2014 South Napa earthquake. Photograph by Erol Kalkan, U.S. Geological Survey.

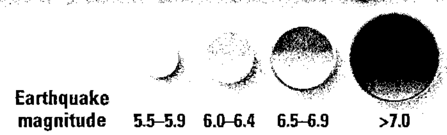


U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2016–3020
Revised August 2016 (ver. 1.1)



1850–1966 earthquakes from Bakun, W.H., 1999, Seismic Activity of the San Francisco Bay Region: Bulletin Seismological Society of America, v. 89, p. 764–784 and 1967–2014 earthquakes from the Northern California Seismic Network.



Likelihood of at least one earthquake greater than a given magnitude in the San Francisco Bay region between 2014 and 2043.

Magnitude (*M*)	30-year likelihood of at least one earthquake in the San Francisco Bay region
$M \geq 6.0$	98 percent
$M \geq 6.7$	72 percent
$M \geq 7.0$	51 percent
$M \geq 7.5$	20 percent

Timeline of magnitude 5.5 and greater earthquakes in the San Francisco Bay region 1850–2014. In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.

Earthquake Preparedness Helps

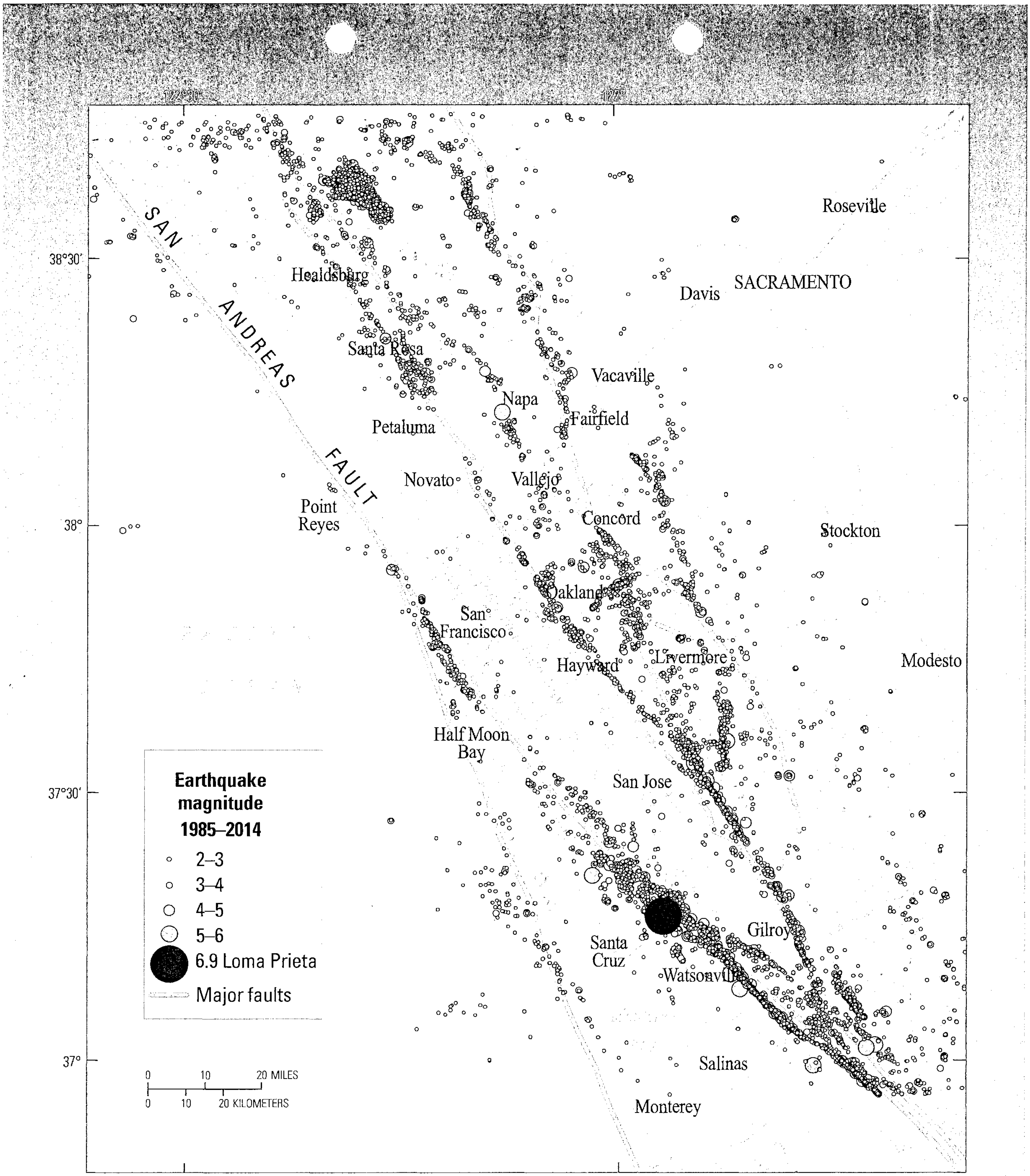
Early Sunday morning on August 24, 2014, the residents of Napa, California, were jolted awake by a strong, magnitude 6.0 earthquake. Within 30 minutes, the staff of Becoming Independent, a non-profit organization that helps adults with intellectual disabilities lead independent lives, called the people they serve in the affected area. The staff quickly visited all of the clients that needed help with cleanup and making their homes safe, a task made easier because both groups were trained in disaster preparedness and the clients had emergency kits with needed supplies on hand. The South Napa earthquake shifted houses off their foundations, damaged chimneys, started fires, and broke water mains throughout the city, causing hundreds of millions of dollars in economic losses. Many historic masonry buildings in downtown Napa were damaged. The earthquake was the largest in the San Francisco Bay region since the 1989 magnitude 6.9 Loma Prieta earthquake and a clear reminder of the seismic vulnerability of the region. The staff and clients of Becoming Independent showed that understanding and preparing for these events can improve how we live with future earthquakes.

Why Does the San Francisco Bay Region Have Earthquakes?

The same geologic process that is responsible for the San Francisco Bay region's beautiful coastlines, bays, hills, and valleys is also the primary driving force for earthquakes along faults in the region. The Bay region is located within the active boundary between the Pacific and the North American tectonic plates, where the Pacific plate slowly and continually slides northwest past the North American plate. The San Andreas Fault, on which two magnitude 7.8–7.9 earthquakes have occurred in historical time, including the 1906 San Francisco earthquake, is the fastest slipping fault along the plate boundary. Other major plate boundary faults in the San Francisco Bay region include the Hayward, Rodgers Creek, Calaveras, Maacama, San Gregorio, Concord, Green Valley, and Greenville Faults.

How Do Scientists Calculate Earthquake Probability?

Scientists rely upon a variety of techniques to help understand the rate and magnitude of past earthquakes in order to estimate the likelihood of future earthquakes. The Global Positioning System (GPS) and other land surveying and geologic techniques have allowed scientists to make more accurate measurements of how the current plate motions—totaling 1.6 inches per year across the San Francisco Bay region—distribute stress onto these individual faults. Balancing plate motions with the slip during large earthquakes and slow creep on faults allows scientists to calculate average rates of earthquake occurrence over periods of hundreds to thousands of years. (Continued on page 4)



Map of earthquakes greater than magnitude 2.0 in the San Francisco Bay region from 1985–2014. Small earthquakes occur on both major faults (shown by the gray lines) and minor faults (not shown). Because of the variability of fault geometry, earthquakes at depth do not always coincide with the mapped faults at the Earth's surface. There are sections of major faults, particularly the San Andreas Fault, with few or no small earthquakes but they will produce large earthquakes in the future. Compiled from the Northern California Seismic Network.

(Continued from page 2). A trench excavated across the Hayward Fault in Fremont revealed evidence of 12 large earthquakes over the past 1,900 years. The time interval between these earthquakes ranged from about 100 to 210 years. Historical records indicate that the most recent large earthquake on this fault occurred in 1868. However, detailed information about other past earthquakes in the San Francisco Bay region is difficult to obtain because seismograph records only go back to about 1900, historical accounts are sparse before 1850, and there are limited locations where faults can be trenched to identify and date prehistoric earthquakes.

Calculating accurate earthquake probabilities for short periods, such as 30 years, is also challenging. Although the 30-year time interval is convenient for humans, it is much less than the average time between large earthquakes on these faults, which can range from hundreds to thousands of years. The rate of large earthquakes in the San Francisco Bay region was high in the late 1800s but dropped abruptly after the 1906 San Francisco earthquake on the San Andreas Fault. Scientists believe that the post-1906 earthquake rate decreased because the large amount of slip along the San Andreas Fault in 1906 temporarily reduced the stress on many of the faults in the region. However, the ongoing motion of the tectonic plates began rebuilding stresses after the 1906 event, and earthquakes larger than magnitude 5.5 resumed during the second half of the 20th century. Future large, damaging earthquakes in the San Francisco Bay region, similar in size to the 1989 Loma Prieta and 1906 San Francisco earthquakes, may or may not be accompanied by the level of earthquake activity observed in the late 1800s.

The 2014 Uniform California Earthquake Rupture Forecast version 3 (http://pubs.usgs.gov/fs/2015/3009/) provides an updated estimate of the likelihood of large earthquakes in California over a 30-year time window from 2014 to 2043. The forecast accounts for how fast stress is accumulating on each fault due to plate motions and the time since its most recent large earthquake(s). In updating the probability calculations, scientists used a more complete set of faults for the San Francisco Bay region than those used in the previous (2008) calculations, adding 32 smaller faults to the 5 major fault systems. The new study has also incorporated more options for how multiple faults might rupture together in large earthquakes.

Probabilities of Earthquakes in the San Francisco Bay Region

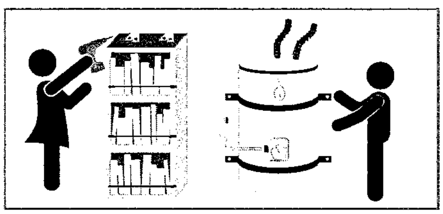
Smaller earthquakes occur more frequently than larger earthquakes. The probability that an earthquake of magnitude 6.0 or larger will occur before 2043 is 98 percent. The probability of at least one earthquake of magnitude 6.7 or larger in the San Francisco Bay region is 72 percent, and for at least one earthquake of magnitude 7.0 or larger it is 51 percent. These probabilities include earthquakes on the major faults, lesser-known faults, and unknown faults.

The probability of a large earthquake occurring on an individual fault in the San Francisco region is lower than the probability of an earthquake occurring anywhere in the region. The faults in the region with the highest estimated probability of generating damaging earthquakes between 2014 and 2043 are the Hayward, Rodgers Creek, Calaveras, and San Andreas Faults. In this 30-year period, the probability of an earthquake of magnitude 6.7 or larger occurring is 22 percent along the San Andreas Fault and 33 percent for the Hayward or Rodgers Creek Faults. Individual sections of these faults have lower probabilities for large earthquakes to occur (continued on page 6);

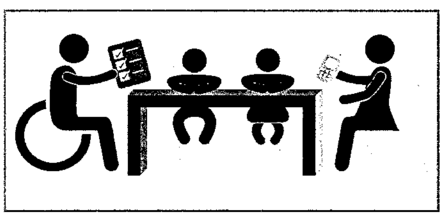
Seven Steps to Earthquake Safety

PREPARE

Before the next big earthquake we recommend these four steps that will make you, your family, or your workplace better prepared to survive and recover quickly:



Step 1: Secure your space by identifying hazards and securing moveable items.



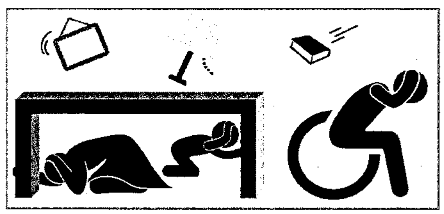
Step 2: Plan to be safe by creating a disaster plan and deciding how you will communicate in an emergency.

Step 3: Organize disaster supplies in convenient locations.

Step 4: Minimize financial hardship by organizing important documents, strengthening your property, and considering insurance.

SURVIVE

During the next big earthquake, and immediately after, is when your level of preparedness will make a difference in how you and others survive and can respond to emergencies:



Step 5: Drop, Cover, and Hold On when the earth shakes.

Step 6: Improve safety after earthquakes by evacuating if necessary, helping the injured, and preventing further injuries or damage.

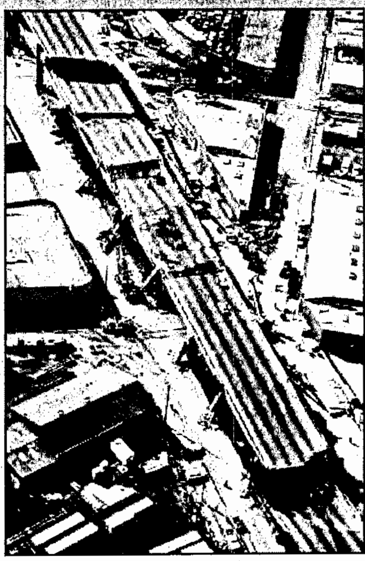
RECOVER

After the immediate threat of the earthquake has passed, your level of preparedness will determine your quality of life in the weeks and months that follow:

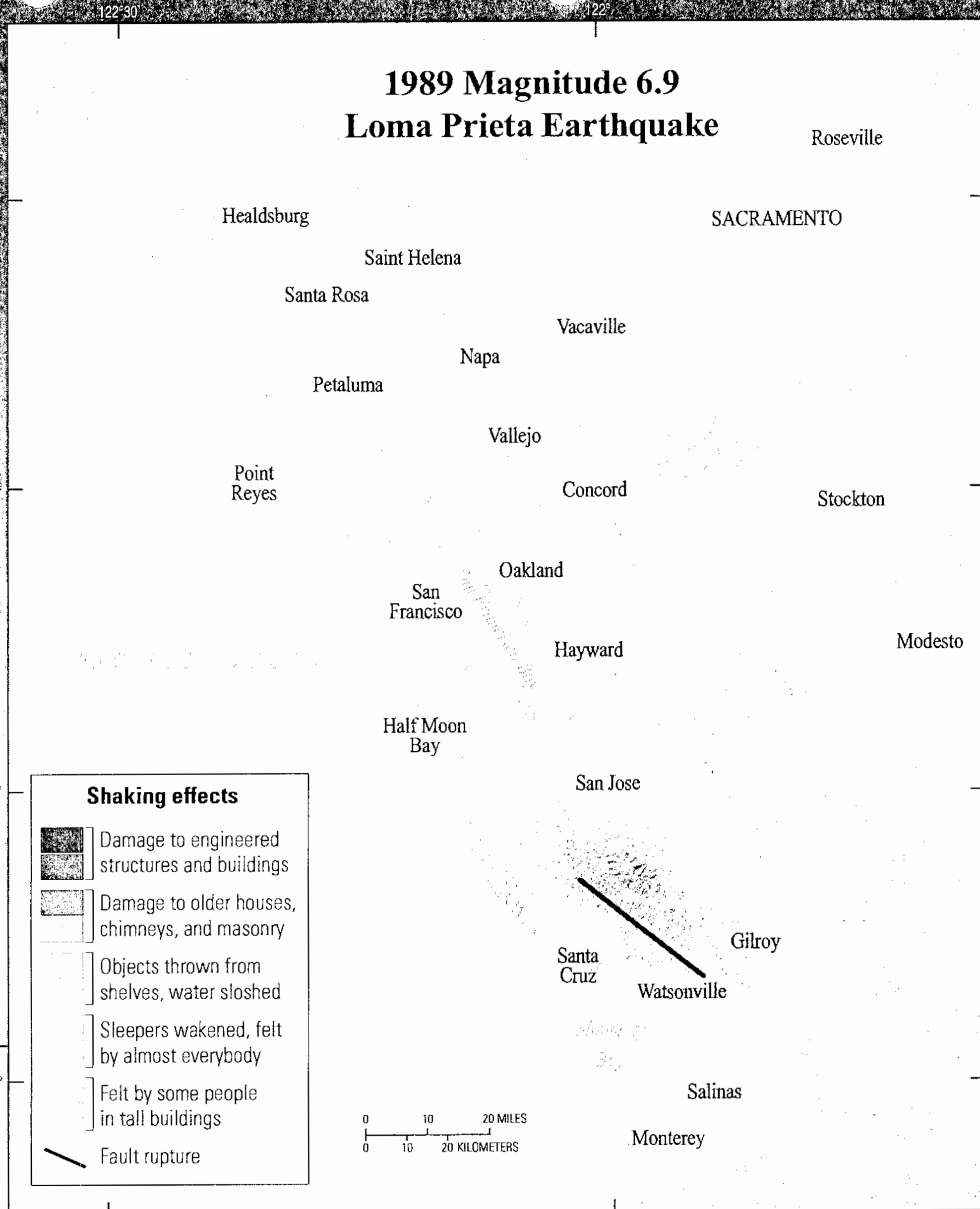
Step 7: Reconnect and Restore. Restore daily life by reconnecting with others, repairing damage, and rebuilding community.

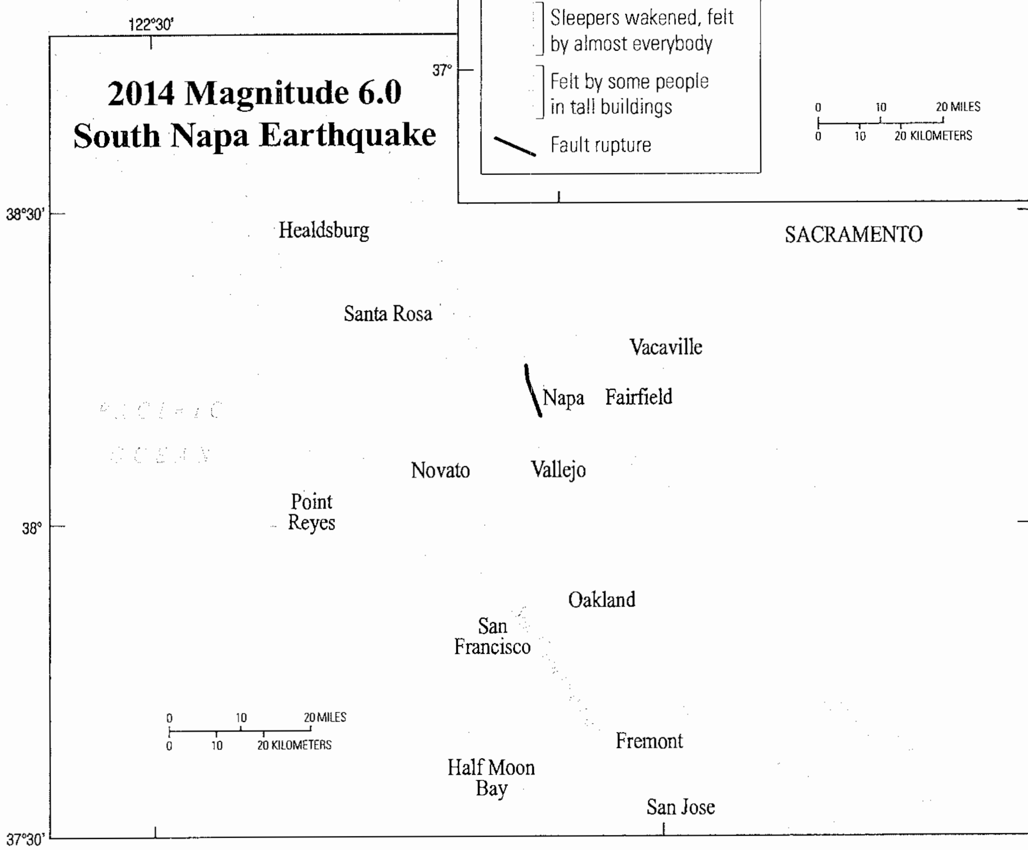
Adapted from Seven Steps To Earthquake Safety
http://earthquakecountry.org/sevensteps/

Maps showing intensity of ground shaking for the South Napa and Loma Prieta earthquakes. The black lines show the location of fault slip at depth. The maps illustrate how the area subjected to strong shaking increases with increasing earthquake magnitude.



Road damage from the Loma Prieta earthquake. Photograph by H.G. Wilshire, U.S. Geological Survey.





Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

Additional Earthquake Resources

American Red Cross – Bay Area (http://www.redcross.org/local/northern-california-coastal)
Association of Bay Area Governments (http://resilience.abag.ca.gov/earthquakes/)
Bay Area Earthquake Alliance (http://bayquakealliance.org/)
California Earthquake Authority (http://www.californiarocks.com/)
California Geological Survey (http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes)
Did You Feel It? (http://earthquake.usgs.gov/earthquakes/dyfi/)
Earthquake Country Alliance (http://earthquakecountry.org/)
Putting Down Roots in Earthquake Country (http://pubs.usgs.gov/gip/2005/15/)
ShakeAlert – An Earthquake Early Warning System for the United States West Coast (http://pubs.usgs.gov/fs/2014/3083/)
ShakeMap (http://www.cisn.org/shakemap/nc/shake/index.html)
ShakeOut.org (http://www.shakeout.org/california/bayarea/)
Uniform California Earthquake Rupture Fault version 3 Fact Sheet (http://pubs.usgs.gov/fs/2015/3009/)
United Policyholders (http://www.uphelp.org/)
USGS Real-Time Earthquakes (http://earthquake.usgs.gov/earthquakes/map/)

Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

(continued from page 5) however, an earthquake of magnitude 6.7 or larger will cause strong shaking over a broad area. Therefore, it is important to estimate the probability of a large earthquake occurring anywhere in the San Francisco Bay region.

What is the Likelihood That an Earthquake Will Affect You?

Earthquake probabilities are only one component in the evaluation of earthquake hazards. Higher magnitude earthquakes have broader areas of intense shaking and cause more damage than lower magnitude earthquakes. In a magnitude 6.0 earthquake, strong shaking and damage are confined to a localized area, as illustrated by the 2014 South Napa earthquake. In comparison, the 1989 magnitude 6.9 Loma Prieta earthquake caused damage over a region nearly 100 miles long. Local soil and geologic conditions, bedrock type, quality of building construction, and susceptibility to flooding (caused by dam or levee failure) can also affect the amount of damage at a particular site. This was dramatically demonstrated by the 1989 Loma Prieta earthquake, which devastated vulnerable parts of Oakland and San Francisco, more than 50 miles from the fault rupture.

How Can You Protect Yourself and Your Family?

Taking simple steps before and during earthquakes can help protect you and your family, as well as speed your recovery from an earthquake.

Before the next earthquake:

- Assess your home and work space, identify hazards, and secure moveable items.
- Create an emergency plan and organize disaster supplies to sustain you and your family for 72 hours or longer.
- Practice "Drop, Cover, and Hold On" to protect yourself when the ground begins to shake. Learn and practice what to do at home, work, or in school.
- Stay prepared by repeating these steps on a regular basis. For example, reassess your preparedness every year and participate in the annual Great California ShakeOut drill on the third Thursday in October.

Lack of adequate shear walls on the garage level exacerbated damage to this building at the corner of Beach and Divisadero in the Marina District, San Francisco, during the October 1989 Loma Prieta earthquake.

Brad T. Aagaard, James Luke Blair, John Boatwright, Susan H. Garcia Ruth A. Harris, Andrew J. Michael, David P. Schwartz, and Jeanne S. DiLeo

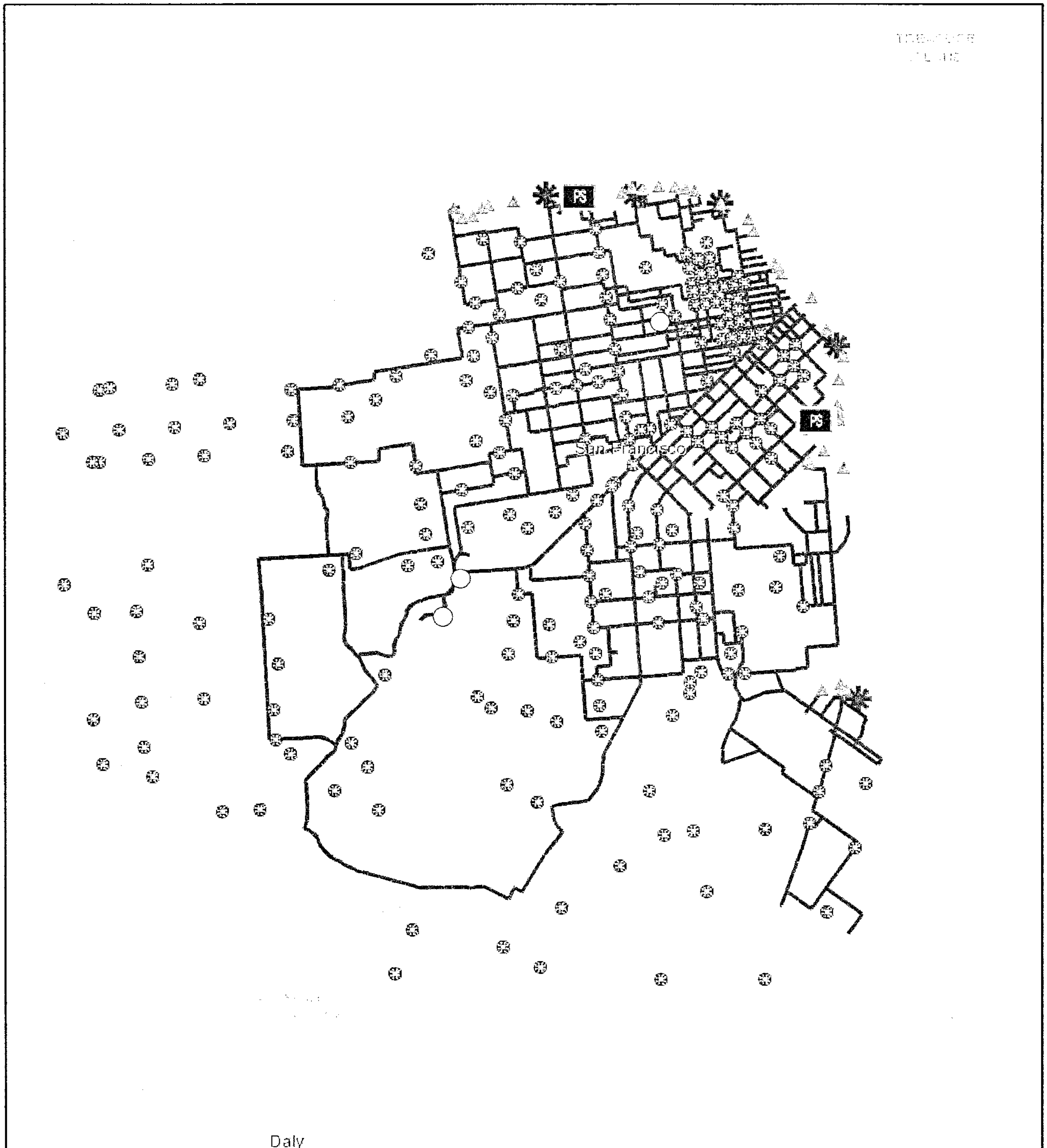
Edited by *Kate Jacques* and *Carolyn Donlin*

For more information contact:
1-888-ASK-USGS
(1-888-275-8747)

http://earthquake.usgs.gov/
http://ask.usgs.gov
https://www.facebook.com/USGeologicalSurvey
https://twitter.com/USGS

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20163020

Appendix H



Existing EFWS - Assets

San Francisco
Water
Services of the San Francisco Public Utilities Commission

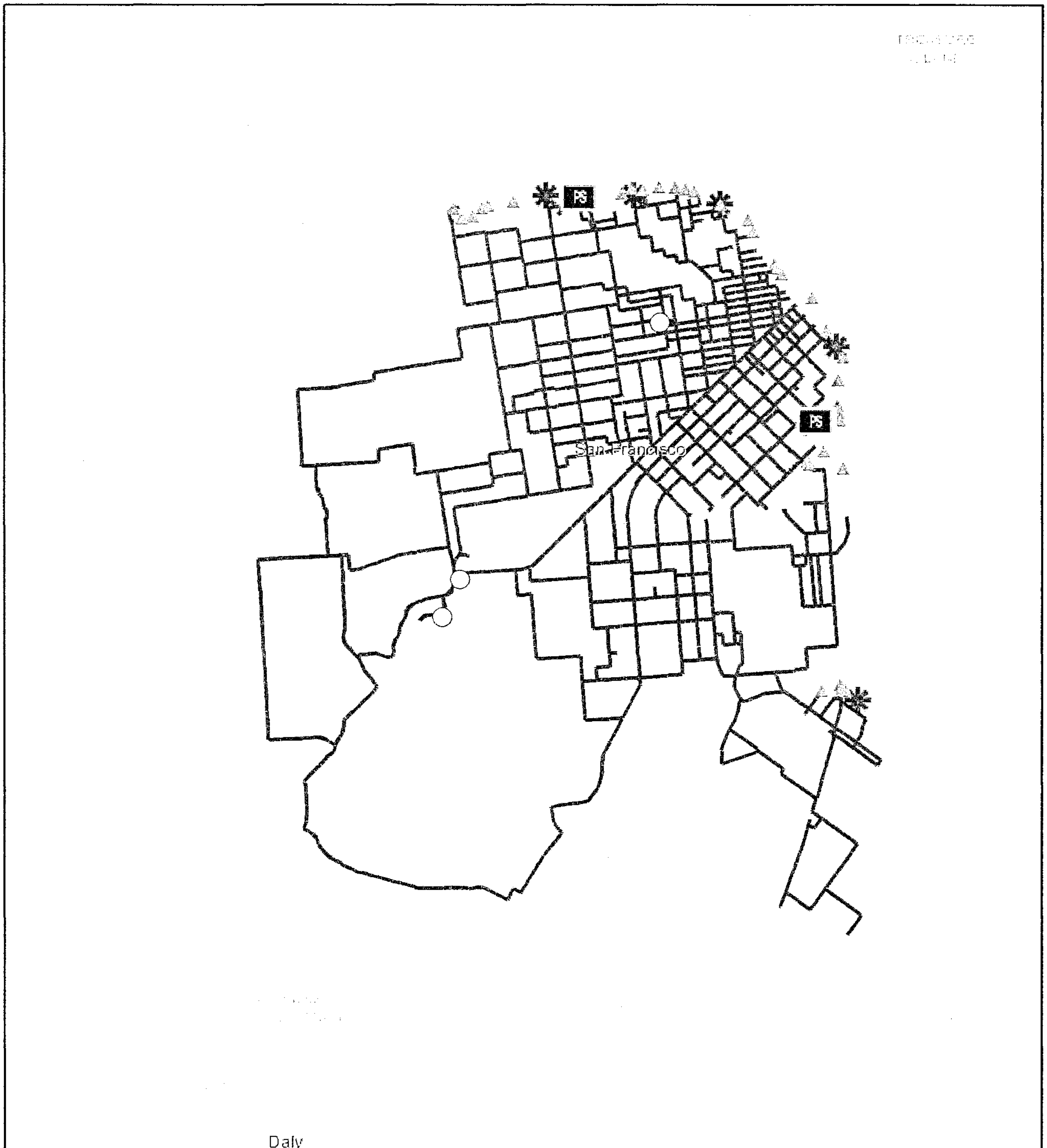
N

Miles
0 0.5 1 2 3

Legend

- AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- Cisterns
- AWSS Pipes

Appendix I



Existing EFWS - Pipelines

San Francisco
Water
Services of the San Francisco Public Utilities Commission

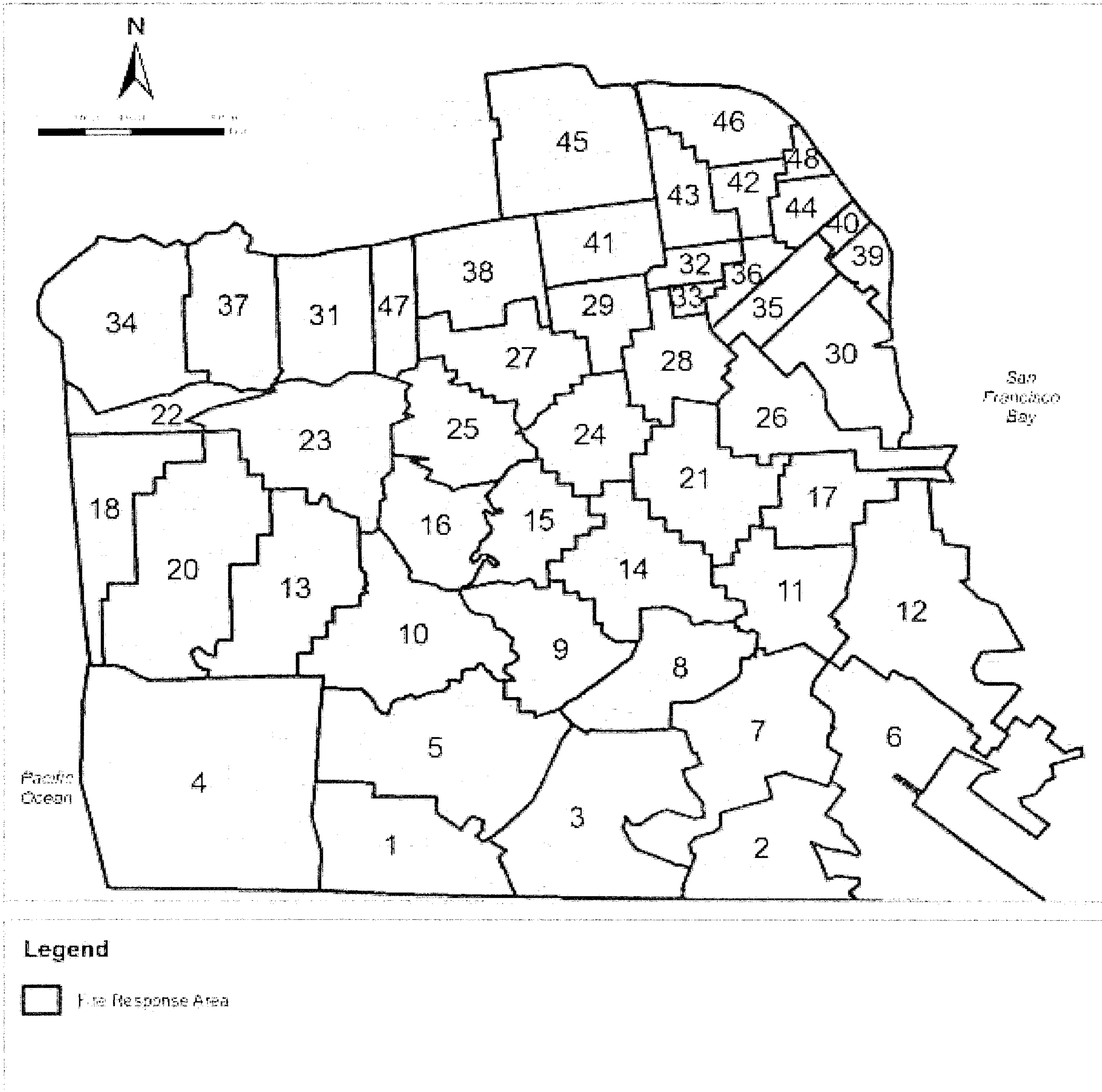
N

0 0.5 1 2 3 Miles

Legend

- AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- AWSS Pipes

Appendix J


N
45
46
48
43
42
44
40
39
41
32
36
33
35
38
34
37
31
47
29
27
28
30
San Francisco Bay
22
25
24
26
23
21
17
18
16
15
14
20
13
11
12
10
9
8
7
6
5
4
Pacific Ocean
3
1
2
Legend
Fire Response Area

Appendix K

Abstract

San Francisco is at significant risk due to fire following earthquake. This report analyzes fire following earthquake for San Francisco as part of a larger project undertaken by the San Francisco Department of Building Inspection entitled Community Action Plan for Seismic Safety (CAPSS). This specific report, on fire following earthquake, has been conducted with the support and assistance of the San Francisco Fire Department (SFFD).

A stochastic model for analyzing fire following earthquake for San Francisco has been developed, utilizing data received from CAPSS, SFFD and others, to assess fire following earthquake impacts due to four earthquake scenarios: magnitude 7.9, 7.2 and 6.5 events on the San Andreas fault near San Francisco, and a magnitude 6.9 event on the Hayward fault. These events cause high ground motions in San Francisco that result in ground failure in many parts of the City – ground motions are particularly high in the western part of San Francisco, which was not yet built up in 1906 and therefore is not protected by the special high pressure SFFD Auxiliary Water Supply System (AWSS). Depending on the specific earthquake scenario, these ground motions and ground failures are estimated to cause over 1,000 breaks in the potable water system, so that SFFD's AWSS and cisterns will be the only source of firefighting water in many parts of the City. The AWSS itself will sustain some damage, forcing SFFD to fall back to cisterns only in some places. At the same time, SFFD's 42 fire engines will almost certainly not be able to respond to all the post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for the magnitude 7.9 San Andreas event. As a result, the methodology employed here estimates ignitions, building burnt areas and dollar losses for the four scenario events. These results are presented in Table A-1 as ranges within which losses will fall half (i.e., 50%) of the time (correspondingly, half the time the losses will be outside – that is, either more or less) than the indicated ranges: .

Table A-1
Bounds for Losses to Buildings due to Fire Following Earthquake

	25% - 75% Confidence Range		
	Ignitions	Loss $ billions	**Total Burnt Building Floor Area** mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~ 28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

For example, for the Mw 7.9 event, essentially a repeat of the 1906 earthquake, losses will on average be about $7.6 billion, and half the time will be more than $4.1 billion and less than $10.3 billion. More detailed results are presented in the report, but the significance of these results is not in their precision, but rather in their overall magnitude. The model producing these results was validated by application to the 1989 Loma Prieta event, and examined for methodological and parametric sensitivity, with satisfactory results.

A number of opportunities exist for reducing the fire following earthquake in San Francisco, including further improvements in reliability of post-earthquake water supply, further support for NERT, and greater training for this problem for SFFD officers and firefighters.

Appendix L

Fire Protection Bonds (A)

PROPOSITION A

FIRE PROTECTION SYSTEM IMPROVEMENT BONDS, 1986. To incur a bonded indebtedness of $46,200,000 for the improvement of the fire protection system within the City and County of San Francisco.

YES 273 ➡
NO 274 ➡

Analysis

by Ballot Simplification Committee

THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.

THE PROPOSAL: Proposition A would authorize the City to borrow $46,200,000 by issuing general obligation bonds. This money would pay for improvements in San Francisco's fire protection system. These improvements would include extending the high pressure system, construction of new cisterns in residential areas, installation of a high pressure pump station at Lake Merced, construction of an emergency operations center, and other projects. The interest and principal on general obligation bonds are paid out of tax revenues. Proposition A would require an increase in the property tax.

A YES VOTE MEANS: If you vote yes, you want San Francisco to issue general obligation bonds totalling $46,200,000 to make certain improvements in the City's fire protection system.

A NO VOTE MEANS: If you vote no, you do not want San Francisco to issue bonds for these improvements in the City's fire protection system.

Controller's Statement on "A"

City Controller John C. Farrell has issued the following statement on the fiscal impact of Proposition A:

"Should the proposed Resolution be authorized and when all bonds shall have been issued on a twenty **(20) year basis** and after consideration of the interest rates related to current municipal bond sales, in my opinion, it is estimated that approximate costs would be:

Bond Redemption	$46,200,000
Bond Interest	38,808,000
Debt Service Requirement	$85,008,000

"Based on a single bond sale and level redemption schedules, the average annual debt requirement for **twenty-two (22)** years would be $3,864,000 which amount is equivalent to approximately one and twenty hundreths cents ($0.0120) in the current tax rate."

How "A" Got on the Ballot

On July 28 and August 4 the Board of Supervisors voted 8-0 in favor of the ordinance placing Proposition A on the ballot.

The ordinance was signed by Mayor Dianne Feinstein on August 6.

THE FULL LEGAL TEXT OF PROPOSITION A APPEARS ON PAGE 96

NOTE: YOUR POLLING PLACE MAY HAVE CHANGED. PLEASE REFER TO MAILING LABEL ON BACK COVER.

NO ARGUMENT WAS SUBMITTED AGAINST PROPOSITION A

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

In 1906, as dawn was about to break on April 18, a giant earthquake hit the City, touching off 52 separate fires. Those downtown swiftly joined in a huge conflagration that swept westward from the waterfront, leaving much of the City in ruins.

If another major quake strikes—(and seismic experts say it will, but they can't pinpoint when), the City must be prepared.

Our firefighters must have sufficient water to fight spreading fires and quickly to control them. That's the only way our City will survive.

In 1906, water mains broke and left the City defenseless.

Proposition A will assure adequate water in every neighborhood throughout the City.

Proposition A will provide $46 million in general obligation bonds to expand and improve emergency water supplies throughout the City. Residential areas will be provided with underground cisterns, and the high-pressure water supply system will be extended. Suction hose connections to City lakes, San Francisco Bay and the Pacific Ocean will provide additional millions of gallons of water.

These emergency fire-fighting water supplies are necessary to protect our homes, schools, hospitals, churches and other structures from the threat of fire that inevitably comes with a monstrous quake.

This increased fire protection will benefit the entire City and all who live, work and vist here.

Vote Yes on Proposition A.

Dianne Feinstein, Mayor

ARGUMENT IN FAVOR OF PROPOSITION A

As a result of the earthquake and fire in 1906, San Francisco suffered great destruction and devastation from the conflagration which followed, including the destruction of 28,000 buildings.

Due to broken water mains caused by the earthquake, the San Francisco Fire Department was unable to stop the fire from getting out of control.

Proposition A will provide for the expansion of a high pressure fire-fighting water system to the residential districts of the City, which will be critical in emergency situations.

Underground cisterns also will be constructed in the outer residential districts to provide emergency water supply in areas not served by the high pressure system.

High pressure system gate valves will be motorized with emergency battery powerpacks so they can be opened and closed in an emergency when normal power is disrupted.

Suction connections will be provided to San Francisco Bay, the Pacific Ocean, and City lakes so that fire department pumpers can quickly connect and pump water from these large bodies of water to any fires.

A pumping station for the high pressure system will be constructed at Lake Merced to provide an important source of water from the western part of the City.

An Emergency Operations Center will be built to provide a command center for operations in earthquakes and other major disasters.

The recent fire and explosion in the Hunter's Point district demonstrated the critical need for water supplies in a major fire. The broken water main caused by the explosion severely hampered the Fire Department in controlling this major fire. This is an example of what can happen when normal water supplies are disrupted.

Increased earthquake activity in California demonstrates the importance of this Proposition.

The fire department can function only if an adequate water supply exists. Proposition A will provide an emergency fire-fighting water supply for the City, and ensure that fires will not get out of control due to lack of water, following an earthquake.

We urge all citizens to vote yes on Proposition A. This is protection for your home and your City.

—Submitted by the Board of Supervisors

ARGUMENT IN FAVOR OF PROPOSITION A

The Fire Commission and Chief of Department urge a YES vote on Propositon A—a $46.2 million Earthquake Preparedness Program.

This construction Program is designed to provide an updated and expanded emergency water supply system so that all areas of the City and County of San Francisco will be protected in case of a conflagration following an earthquake or other disaster.

The major components of the Program are: high-pressure water supply extensions, underground cisterns, pumping station, emergency operations center, suction hose connections to the Bay and lakes, and a study to determine fire station reconstruction needs and their earthquake safety.

Help the San Francisco Fire Department provide increased fire protection. **VOTE YES ON PROPOSITION A.**

Henry E. Berman, President, Fire Commission
Curtis McClain, Vice President, Fire Commission
Juanita Del Carlo, Commissioner, Fire Commission
Richard J. Guggenhime, Commissioner, Fire Commission
Anne S. Howden, Commissioner, Fire Commission
Emmet D. Condon, Chief of Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans will not forget, nor should they, the tragic Bayview/Hunter's Point fire on April 4, 1986. Coincidentally, two earthquakes rocked the Bay Area in the weeks following the Bayview fire.

Following the Bayview fire, I requested Board of Supervisors hearings to investigate the adequacy of San Francisco's emergency water supply in the Bayview, Ingleside, Balboa Terrace, Oceanview, Lakeside, Forest Hill, Crocker-Amazon, St. Francis Wood, West Portal, Diamond Heights, Visitacion Valley, Merced Manor, Excelsior, Portola, Silver Terrace, Miraloma Park, Forest Knolls, Inner Sunset, Lakeshore Acres, Monterey Heights, and Outer Mission neighborhoods, and to implement a program to correct deficiencies in our emergency firefighting capabilities. From these hearings and deliberations of the Fire Commission, Proposition A emerged.

VOTE YES ON A.

Proposition A is a $46,200,000 general obligation bond issue to construct a comprehensive emergency water supply system and an emergency operations center for firefighting in the event of a disaster.

That may seem like a lot of money, but it represents, in this case, a prudent, far-sighted investment in San Francisco's future. Unfortunately, we can't guarantee another Bayview-type fire won't happen. But we can be better prepared if one **does** happen, and significantly reduce the risk to life and property in the Bayview, Hunter's Point, the Outer Mission, and all of the West of Twin Peaks area.

Please vote "Yes" on A.

Quentin L. Kopp, Supervisor

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquakes are a major concern to all of us who live in California, and a potential cause of disaster for San Francisco. Following a major earthquake it is highly likely that multiple fires will occur. San Francisco with its highly congested blocks of wooden buildings would face a conflagration (fire storm), if a major earthquake caused water supplies to be disrupted.

Proposition A, as an Earthquake Preparedness measure, is very important for San Francisco. It will provide for Emergency Water Supply necessary for fire fighting.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Bruce Bolt, Professor of Seismology
Karl V. Steinbrugge, Past Chairman
California Seismic Safety Commission
Charles Scawthorn, Structural Engineer
Joe J. Litehiser, Seismologist
Donald H. Cheu, M.D., Vice Chairman
Governor's Earthquake Task Force

ARGUMENT IN FAVOR OF PROPOSITION A

We support this important Earthquake Preparedness Program.
VOTE YES ON PROPOSITION A.

Willie L. Brown, Jr., Speaker of Assembly
Michael Hennessey, Sheriff
Morris Bernstein, President, Airports Commission
Douglas Engmann, Commissioner, Board of Permit Appeals
E. L. Friend, President
Anne Halstead, Commissioner, Port Commission
Thomas E. Horn, President, War Memorial Board of Trustees
Melvin D. Lee, Commissioner, Redevelopment Commission
Robert J. McCarthy, Vice President, Board of Permit Appeals
Al Nelder, Commissioner, Police Commission
Michael Salarno, Member, S.F. Parking Commission
William K. Coblentz, Attorney
Gordon J. Lau, Attorney
Steven L. Swig, Attorney

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection for San Francisco's neighborhoods is a vital factor. Emergency Water Supplies for fire fighting are necessary so that the Fire Department can provide ample protection to our homes in the event an earthquake damages water mains as occurred in 1906.

Proposition A will expand and improve the Fire Department's Emergency Water Supplies.

- Suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- Underground cisterns will be provided in residential areas.
- The High-Pressure System will be extended to outer residential districts.

The cost of Proposition A is .0120 cent per $100 valuation on the property tax; this means a home valued at $150,000 would pay $17.16 per year for this protection. This is highly cost effective insurance for our homes.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Marguerite A. Warren
James J. Walsh, Jr.
Dorothy Agnes McDougall
Andrew Jones
George L. Newkirk
Jess T. Esteva
Dolph Andrews
Norman V. Wechsler

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection and Earthquake Preparedness concern all school officials in San Francisco.

Proposition A is an important program that will provide **Emergency Water Supplies For Fire Fighting** throughout the City.

When a major earthquake strikes, the Fire Department must have a dependable water supply to protect our families, homes and schools.

Earthquakes cannot be stopped, but we must have water to stop the fires that will occur.

We ask all citizens to join us and **VOTE YES ON PROPOSITION A.**

Myra A. Kopf, President, Board of Education
A. Richard Cerbatos, Vice President, Board of Education
Libby Denebeim, Member, Board of Education
JoAnne Miller, Member, Board of Education
Benjamin Tom, Member, Board of Education
Sodonia M. Wilson, Member, Board of Education
Rosario Anaya, Member, Board of Education
Ernest C. Ayala, President, S.F. Community College Board
Al Vidal, Principal, Washington High School

ARGUMENT IN FAVOR OF PROPOSITION A

Improved and expanded Emergency Water Supplies for fire fighting in San Francisco are a necessary factor to prevent another conflagration (fire storm) from sweeping the City as occurred in 1906.

Our central business and financial districts are the economic heart of the City, the residential districts contain the homes of our citizens.

Proposition A provides increased fire protection to our high-rise buildings and our homes.

Earthquake preparedness and protection from the ravages of fire concern us all. As civic leaders of San Francisco we urge all citizens to **VOTE YES ON PROPOSITON A.**

Lee Dolson, General Manager, Downtown Association
James R. Bronkema, President, Embarcadero Center

ARGUMENT IN FAVOR OF PROPOSITION A

We can bet that most of you have seen the circles of bricks encompassing certain intersections in some neighborhoods in San Francisco. These circles mark underground water cisterns that were constructed "after" the devastating earthquake and fire in 1906. Many neighborhoods in San Francisco built after 1912 are NOT serviced by this alternate water system.

Proposition A would provide a City-wide emergency water supply system to protect our homes and neighborhoods.

We cannot prevent earthquakes but we can take precaution against fire. . .the biggest threat to San Francisco.

We urge a YES vote on Proposition A. . .fire protection for our families no matter where they may be in our City.

Nancy Honig
Roxanne Mankin
Jane McKaskle Murphy
Bernice E. Ayala
Cheryl Arenson
Gina Moscone
Jonnie B. Johnson

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and increased fire protection are of vital concern to all citizens of San Francisco.

VOTE YES ON PROPOSITION A.

Robert Bacci
Michael Bernick
Susan Bierman
Frank T. Blackburn
Rev. Dr. Amos C. Brown
Sally Brunn
Stafford Buckley
Michael Chan
Charles D. Cresci
Rosemary DeGregorio
Todd Dickinson
H. Welton Flynn
Ron Huberman
Ralph Hurtado
David Jenkins
Agar Jalcks
Carole Migden
Polly V. Marshall
Alicia Wang
Thomas F. McDonough
Tony Kilroy
Leroy King
David Looman
Christopher Martin
Peter Mezey
Marilyn Miller
Jeff Mori
Sandy Mori
Yoshio Nakashima
Mitchell Omerberg
Edward J. Phipps
Linda Post
Thelma Shelley
Robert J. Tully
Yori Wada
Evelyn Wilson
Pansy Panzio Waller
Bruce W. Lilienthal
Jim Wachob

ARGUMENT IN FAVOR OF PROPOSITION A

Pure self interest dictates that we provide an abundant and surplus supply of "fire protection" water for EVERY part of San Francisco, not just half of it! VOTE YES!

W. F. O'Keeffe, Sr., San Francisco Taxpayers Association

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Fire Protection Bonds A

ARGUMENT IN FAVOR OF PROPOSITION A

Emergency water supplies for fire fighting are vital for San Francisco. On April 4, 1986, an explosion and fire occurred in the Bayview District, causing nine deaths. The disrupted water supply caused by the explosion, severely hampered the Fire Department in controlling this fire.

In the event of a major earthquake it is highly likely that water mains will be damaged throughout San Francisco. Proposition A will provide for 94 underground cisterns to be built in residential areas where few emergency water supplies now exist. The Bayview fire demonstrated the need for emergency water supplies for fire fighting.

Protect your neighborhood and home.

VOTE YES ON PROPOSITION A.

Concerned Citizens for Improved Fire Protection

Michael Frew, Chairman
John Holt
Robert L. Kreuzberger
Ed F. Patterson
Michael S. Newman
Mel S. Newman
Jack R. Brower
August J. Nevolo

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans remember what happened in 1906. The fires that occurred after the earthquake swept the City and left many thousands of people homeless.

Proposition A is a common sense program to provide **Emergency Water Supplies for Fire Fighting** throughout the City. This would ensure that fires would not get out of control due to lack of water supply.

This $46.2 million bond issue needs a two-thirds vote. As a former member of the Board of Supervisors and neighborhood businessman, I urge all citizens to vote for this important program. It is protection for your family, home and city at a very low cost; it makes sense in both human and economic terms.

VOTE YES ON PROPOSITION A.

John Barbagelata, Realtor

ARGUMENT IN FAVOR OF PROPOSITION A

Proposition A assures San Francisco residents of on-going preparation which is the best defense against a major disaster— earthquake, conflagration, or an explosion.

San Francisco Fire Fighters regard this measure as the first-step in the earthquake preparedness program.

Control disaster with expanded fire protection!

San Francisco Fire Fighters urges a **YES** vote on Proposition A.

James T. Ferguson, President,
San Francisco Fire Fighters Local 798

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection is a serious concern for all citizens of San Francisco. We, the working Fire Chiefs of San Francisco are well aware of what happened in 1906, when fires occurring after the great earthquake burned thousands of buildings and left over 200,000 homeless.

The quake caused hundreds of breaks in water mains and the lack of water supplies prevented the Fire Department from controlling the fire.

We do not want this to happen again.

Proposition A will provide **Emergency Water Supplies for Fire Fighting.** The following installations will be placed in our neighborhoods to protect our homes.

- 94 underground cisterns will be built.
- 56 suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- The High-Pressure System will be extended to residential areas.
- Improvements to tanks, reservoirs, pump stations, including a new pump station at Lake Merced and an Emergency Operations Center.

The recent fire in the Bayview District that took nine lives demonstrated how important water supplies can be. The damaged water supply caused by the fire and explosion seriously hampered Fire Department efforts to control this major fire.

We as the working Fire Chiefs who actually run the day-to-day field operations in San Francisco urge all citizens to support this important measure.

VOTE YES ON PROPOSITION A.

John W. Flaherty
President, The San Francisco Fire Chiefs Association
Gary J. Torres
Secretary, The San Francisco Fire Chiefs Association

ARGUMENT IN FAVOR OF PROPOSITION A

Fire safety can be improved by voting FOR Proposition A and AGAINST BART director Eugene Garfinkle. BART's a fire trap.

Tom Spinosa, BART Board candidate

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and Fire Protection are vital factors for all citizens.

VOTE YES ON PROPOSITION A.

A. Cecil Williams, Glide United Methodist Church
Bob Barry, President, S.F. Police Officers Association
William Corvin, President, California Steam Company
J. M. Eaneman, President, AMC Cancer Research Board of Directors
George Foos, Chairman, Great Western Value Centers
Rev. John L. Green, Chaplain, S.F. Fire Department
Albert S. Samuels, Jr., Past President, Market Street Project
Harvey Matthews, Bayview-Hunter's Point Democratic Club
Arthur Goedewaagen, President, Sunset-Parkside Education & Action Committee

ARGUMENT IN FAVOR OF PROPOSITION A

Prior to the Great Earthquake and Fire of 1906, San Francisco Fire Chiefs had always insisted the City was not prepared for a major disaster. History proved them correct. Today, 80 years later, San Francisco's preparation is still not adequate.

When each of us was Chief of Department, we emphasized the need for the additional preparedness necessary to prevent a sweeping fire storm or catastrophic disaster. That state of preparedness has yet to be attained. However, Proposition A offers a once-in-a-life opportunity to protect life and property, through preparation, at an extremely minimal cost. This opportunity should not be missed.

Proposition A will provide the necessary water supplies vital to preventing another conflagration of the 1906 magnitude!

Proposition A will expand the high-pressure firefighting water supply system beyond the commercial areas into the residential neighborhoods!

Proposition A will greatly improve fire defenses not only in the western part of San Francisco but City-wide as well!

Proposition A will ensure that San Francisco is no longer one of the few remaining major cities with a sub-standard Emergency Operations Center for command and control during disasters and earthquakes!

As former San Francisco Fire Chiefs, we urge you to **VOTE "YES" ON PROPOSITION A.**

William F. Murray, Chief, San Francisco Fire Department, Retired
Keith P. Calden, Chief, San Francisco Fire Department, Retired
Andrew C. Casper, Chief, San Francisco Fire Department, Retired

ARGUMENT IN FAVOR OF PROPOSITION A

- Yes on Proposition A.
- Local fire chiefs have warned about grave BART fire catastrophe dangers. End disregard of public safety.

—San Franciscans for BART Safety

ARGUMENT IN FAVOR OF PROPOSITION A

This is a vital issue for San Francisco. **Emergency Water Supplies for Fire Fighting** must be provided throughout the City.

Many fires will occur if a major earthquake strikes San Francisco.

The Fire Department needs a water suply to prevent a conflagration (fire storm) from occurring again, as it did in 1906.

Earthquakes are a geologic fact of life and cannot be prevented, but we can prepare for the fires that will occur, this makes sense for all citizens.

VOTE YES ON PROPOSITION A.

Philip S. Day, Jr.
Director, San Francisco Office of Emergency Services
Richard Eisner, Earthquake Preparedness Consultant
Jelena Pantelic, Chairperson, Disaster Preparedness Committee
Joe Posillico, Emergency Services, Salvation Army
Peter Ashen, Disaster Director, American Red Cross

ARGUMENT IN FAVOR OF PROPOSITION A

San Francisco Council of Civic Organizations endorsements:
Proposition A—YES
Proposition M—YES

Terence Faulkner
President, San Francisco Council of Civic Organizations

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and providing Emergency Water Supplies for Fire Fighting are of vital importance to San Francisco.

VOTE YES ON PROPOSITION A.

Donald J. Birrer, Director of Public Works
Frank M. Jordan, Chief of Police
Dean Macris, Director of Planning
Rudy Nothenberg, General Manager, Public Utilities
William Stead, General Manager, Municipal Railway
David Werdegar, M.D.M.P.H., Director of Public Health
James D. Cooney, General Manager, S.F. Water Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Appendix M

FIRE COMMISSION

City and County of San Francisco

Gavin Newsom, Mayor

698 Second Street
San Francisco, CA 94107
Telephone 415.558.3451
Fax 415.558.3413
Monica Quattrin, *Commission Secretary*

SAN FRANCISCO FIRE COMMISSION

RESOLUTION 2010-01

ENCOURAGING THE FIRE DEPARTMENT TO PURSUE GRANT FUNDING IN THE AMOUNT OF $9.785 MILLION FROM THE FEDERAL GOVERNMENT, TO EXPAND THE DEPARTMENT'S PORTABLE WATER SUPPLY SYSTEM.

WHEREAS, The uniformed employees of the San Francisco Fire Department (SFFD) respond to approximately 100,000 incidents a year; and,

WHEREAS, It is the responsibility of the SFFD and its members to protect the lives and property of the citizens of San Francisco from the effects of natural disasters; and,

WHEREAS, The United States Geological Survey has issued increasingly frequent warnings of the high probability of a potentially catastrophic earthquake in the San Francisco Bay Area during the next thirty years; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the spread of fire following earthquakes in modern urban settings, have predicted that there is a high likelihood that San Francisco will be subject to multiple simultaneous conflagrations following a major Bay Area earthquake; and,

WHEREAS, The assessed value of the real estate in San Francisco subject to property taxation exceeds $100 billion; and,

WHEREAS, The spread of fire following earthquakes in a modern urban setting typically is responsible for as much as 75% of the total dollar loss that results; and,

WHEREAS, Loss of life following an earthquake in a modern urban setting is greatly exacerbated by the effects of resultant fires in buildings where occupants have been trapped by structural collapse; and,

WHEREAS, The Auxiliary Water Supply System does not cover the entire geographic areas of the City and County of San Francisco; and,

WHEREAS, The SFFD's Portable Water Supply System has been proven effective in the above-ground transmission of water for fire fighting purposes; and,

WHEREAS, The Portable Water Supply System works in conjunction with and can supplement the existing Auxiliary Water Supply System, and therefore the Portable Water Supply System is capable of partially mitigating the possible lack of domestic water system availability following a major earthquake; and,

WHEREAS, the number of units currently comprising the SFFD's existing Portable Water Supply System is not adequate to supply all areas of San Francisco where the Auxiliary Water Supply System does not extend; and

WHEREAS, the proposed design for expanding the Portable Water Supply System has been shown to be a highly cost effective and functionally adaptable method of providing the means by which firefighters can attack multiple conflagrations simultaneously;

WHEREAS, the SFFD is working with Senator Dianne Feinstein and Speaker of the House Nancy Pelosi in seeking these grant funds, now therefore, be it

RESOLVED, That the Fire Commission encourages the Fire Department to actively pursue grant funds in the amount of $9.785 million from the Federal government, to expand the Portable Water Supply System and train SFFD uniformed members, the Fire Reserve, and other members of the community who may assist the SFFD in times of disaster.

Adopted at the Regular Meeting of the San Francisco Fire Commission on January 14, 2010.

Ayes: 4 (Makras, Nakajo, Lau, Evans)
Nays: 0

Monica Quattrin

Monica Quattrin, Commission Secretary

Appendix N

Frequently Asked Questions - Fire Suppression Water Systems

San Francisco Water
Services of the San Francisco Public Utilities Commission

1) What is the Auxiliary Water Supply System, and what is its primary function?

The Auxiliary Water Supply System (AWSS) is a non-potable fire-suppression water system that was built the decade following the catastrophic 1906 San Francisco earthquake. The purpose of the AWSS is to provide the San Francisco Fire Department (SFFD) with a high-pressure fire suppression water system that can be utilized during large fires. The system is vital for protection against the loss of life, homes, and businesses from fire following an earthquake and non-earthquake multiple-alarm fires.

There are two aspects of the AWSS that are critical to its success:

1. Distribution infrastructure: The AWSS consists of over 135 miles of high-pressure pipeline and hydrants. The system utilizes approximately 30 seismically-reliable motorized valves, allowing the SFPUC to valve off sections of the system, to ensure that pressure is maintained in areas where fires are occurring.
2. The water supply that feeds into the AWSS distribution infrastructure. The primary source of the AWSS is the SFPUC's Hetch Hetchy Water System.

The original AWSS system consisted of three reservoirs and two seawater pumping stations. Their capacities:

- 10.5 million gallon Twin Peaks Reservoir,
- 0.5 million gallon Ashbury Heights Tank, and
- 0.75 million gallon Jones Street Tank.
- Seawater pump station #1: 10,000 GPM (located in SOMA)
- Seawater pump station #2: 10,000 GPM (located near Aquatic Park)

In 2010, the management of the AWSS was transferred to the San Francisco Public Utilities Commission (SFPUC). A shared goal of the SFPUC and SFFD is doing the following to expand and improve the reliability of the water supply serving the AWSS. The agencies have undertaken the following to do so:

- 95% completion of the $4.8 billion Water System Improvement Program (WSIP), providing robust seismic upgrades to the pipelines, reservoirs, and infrastructure that supply water to San Francisco and the greater Bay Area;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;

- Analyzing the usage of the 90 million gallon North Basin of Sunset Reservoir as a water Supply for a Potable AWSS in the Sunset and Richmond Districts; and
- Investigating the installation of a seawater pump station at Ocean Beach to serve as a secondary source of water for fire suppression for the Sunset and Richmond Districts.

In addition to the AWSS, the SFPUC's low-pressure drinking water system and its low-pressure hydrants, as well as approximately 180 cisterns throughout San Francisco, can be pumped and utilized by SFFD Fire Trucks for fire-suppression.

2) Is the AWSS located throughout San Francisco? If not, why?

The AWSS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the central business district and the majority of the city's population at that time.

The San Francisco Public Utilities Commission (SFPUC), SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the SFPUC intends to use the best possible technology available to meet the performance standards of the SFFD. Please standby for future updates to the SFPUC webpage for images, graphics, and maps showcasing the original AWSS system, recent upgrades, and future projects.

3) Who manages the AWSS, the SFPUC or the SFFD? How does the SFFD know that the AWSS system is being adequately and reliably maintained?

The SFFD owned and managed the AWSS and the fire hydrants on the potable water system from the early 1900s until 2010. During this time the SFFD collaborated with staff from San Francisco Public Works (SFPW) to implement upgrades to the system. In 2010, the AWSS was transferred to the SFPUC, the City's experts in water supply piping systems. By bringing in the SFPUC to work with SFFD and SFPW, City leaders created an interagency team with all of the expertise needed to manage, operate, and update the AWSS.

The SFFD is considered the end user of the system, and therefore system improvements and expansion completed by SFPUC must meet the rigorous and high-quality standards of the SFFD. The SFFD and SFPUC meet monthly to discuss operations of the AWSS, report on maintenance activities, review capital and developmental project design and status, and communicate on policies and procedures that affect both departments.

This partnership presents the best of both worlds for San Franciscans. The women and men of SFFD are internationally-recognized for their expertise, experience, and bravery in fighting fires. Similarly, the SFPUC, with its Hetch Hetchy Water System, is recognized as one of the top water agencies in the world. The SFPUC has hundreds of engineers that are experts in designing, expanding, and improving water systems. Additionally, the SFPUC has over 80 plumbers and dozens of construction management experts in-house that are dedicated to providing high-quality maintenance and oversight of the construction projects needed to keep the AWSS functioning for the SFFD's use.

With the two agencies working together, in partnership with SFPW, the City of San Francisco has the experts it needs to successfully operate, expand, and improve the AWSS.

4) What are the SFPUC and SFFD doing to increase fire protection in the areas of the City that do not have the AWSS?

When the SFPUC took over control of the system, the agency worked with SFFD to complete a review of all existing facilities and a comprehensive Planning Study.

The analysis modeled the hydraulic reliability of the existing AWSS after a major earthquake. In this context of this study, hydraulic reliability is defined as the percentage of the water needed by SFFD to fight fires that would be met by the AWSS and other sources after a 7.8 earthquake on the San Andreas Fault.

Our analysis showed that the 2010 AWSS was 47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake. Utilizing this information, the SFPUC, SFFD, and SFPW identified projects that would increase system reliability and could be funded by the 2010 and 2014 Earthquake Safety and Emergency Response (ESER) Bonds authorized by San Francisco voters. Decisions on which projects to implement utilizing bond funds are based on a given project's ability to improve the reliability score for the Fire Response Area that the given project serves and to increase the likelihood of delivering water after an earthquake.

Bond-funded projects make seismic upgrades to the system and repair, replace, and extend system components to increase the ability to provide adequate water for firefighting. Funding is allocated to repair, replace, and extend system components to improve the ability to provide adequate water for firefighting purposes following a major earthquake and during multiple-alarm fires from other causes. This includes repairs and upgrades to core facilities, pipelines, and tunnels, and construction of new cisterns.

The following projects have been completed utilizing the funds from the 2010 and 2014 bonds:

- Installation of 30 new cisterns (with 15 of these cisterns installed in the Sunset and Richmond districts);
- Reliability upgrades at the three primary source supplies – Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- 6 pipeline and tunnel projects.

The following projects are in construction and/or design phase:

- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- 16 pipeline and tunnel projects;
- Motorizing critical seismically-reliable valves for remote control, and improving the electronic control system of the valves; and
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;
- Preliminary analysis for a Potable AWSS for the Sunset and Richmond Districts. *Additional information on that system can be found in questions 6-11.*

Once fully completed, the projects implemented with the ESER 2010 bond funds will increase the citywide reliability score from 47% to 67%. The full completion of the projects implemented with the ESER 2014 bond funds will increase the citywide reliability score from 67% to 87%. Construction of additional recommended future projects will increase the citywide reliability score to 96%.

5) Who makes decisions on the selection and implementation of AWSS projects? Who reviews the progress and implementation of AWSS capital projects?

Overseeing the selection and implementation of AWSS projects is the Management Oversight Committee consisting of SFPUC General Manager Harlan Kelly, SFFD Chief Joanne Hayes-White, SFPW Director Mohammed Nuru, and SFPUC Assistant General Manager of Water Steve Ritchie.

The San Francisco Capital Planning Committee, consisting of the City Administrator and including the President of the Board of Supervisors, the Mayor's Budget Director, the Controller, the City Planning Director, the Director of Public Works, the Airport Director, the Executive Director of the Municipal Transportation Agency, the General Manager of the Public Utilities System, the General Manager of the Recreation and Parks Department, and the Executive Director of the Port of San Francisco, reviews the progress and implementation of AWSS capital projects. Capital Planning Committee meetings are open to the public. Please find more info at the Committee's webpage.

6) Are the SFPUC and SFFD looking at something called a Potable AWSS for fire suppression on the Westside of San Francisco. What is a Potable AWSS? How does it function? How is it different from the existing AWSS?

The word "potable" is defined as "safe to drink". The Potable AWSS currently under analysis will connect to the 90 million gallon North Basin of the Sunset Reservoir, and will provide a high-pressure firefighting system for the SFFD to fight fires in the Richmond and Sunset Districts. **The Potable AWSS will meet the same rigorous standards required by SFFD to fight large fires, and will utilize the same earthquake resistant pipes, seismically-reliable valves, hydrants, and components utilized by the AWSS, and therefore will be designed to function at the high-pressure level required by SFFD.** The Potable AWSS project is currently in the planning and analysis phase. The SFPUC will work with SFFD to design the system with operational capabilities and design criteria standards equal to or exceeding the existing AWSS.

The Potable AWSS will also have roughly 5 connections to potable water pipes in the Sunset and Richmond districts. **These connections will utilize the same valves as the 30 valves the existing AWSS currently uses to isolate sections of the AWSS to maintain system pressure.** Additionally, these 5 valves will be tested at the same schedule as the existing valves to ensure their performance during an incident. During non-fire events, the Potable AWSS pipeline will be one of many pipes supplying drinking water to the Richmond and Sunset districts.

In the event of a major fire, the approximately five isolation valves will be closed automatically, remotely, or manually, which are the same methods that the 30 valves on the existing AWSS utilize. These five isolation valves will be closed so that the Potable AWSS will be disconnected from the City's low-pressure water system and therefore can provide reliable high-pressure water for fire-fighting. If the Potable AWSS is isolated for firefighting use, homes and businesses will continue to be served by other redundant low-pressure drinking water distribution pipes, assuming that those low-pressure pipes have not incurred numerous breaks and leaks during the earthquake.

An additional benefit of the Potable AWSS is that it will be designed and constructed to meet required AWSS performance standards, and the system will be rated to meet drinking water standards. This means that after firefighting following an earthquake, the Potable AWSS will be able to provide drinking water to the Sunset and Richmond Districts even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

7) Does the Potable AWSS provide an equivalent amount of fire suppression when compared to the existing AWSS? Does the Potable AWSS provide the water pressure and supply of water needed by SFFD to fight small and large fires?

Yes. The Potable AWSS will be designed to meet all SFFD performance requirements. The SFFD will not reduce or lower their robust performance standards, and therefore the SFPUC must design, construct, maintain, and operate the Potable AWSS system to meet these standards. The SFPUC is currently working in conjunction with SFFD to design a system that will have pressure and performance capabilities equal to or exceeding AWSS.

8) Does the Potable AWSS use the same type of earthquake resistant piping and valves as the AWSS?

Yes. The Potable AWSS will use earthquake resistant piping that is equal or better than the current AWSS piping design standard. Additionally, the Potable AWSS will utilize the same seismically-reliable valves as the 30 existing valves currently utilized by the AWSS to isolate sections of the system to ensure supply reliability in areas with fires. The hydrants utilized will also be the same as the existing AWSS. All of these components will be able to property function at the high-pressure levels required by SFFD.

9) The Potable AWSS relies on automatic valves to boost the water pressure to the level needed to fight big fires. What if the automatic valves fail, will SFFD be without the water they need to fight big fires? Does the existing AWSS rely on these automatic valves to fight fires? Does the Potable AWSS rely on more of these valves than the existing AWSS?

The potable AWSS will be isolated after an earthquake from the remainder of the distribution system by seismically-reliable motorized valves using the same method and equipment as current AWSS valves. All valves, future and existing, have redundant safeguards and a maintenance program that will ensure their performance. The valves can be operated manually if the valve actuators fail, just like the existing AWSS motorized valves. The valves are utilized by the existing AWSS and the future Potable AWSS to isolate sections of pipe to ensure that the systems provide the water supply and pressure needed by SFFD to fight big fires.

The quantity of the motorized valves on the future Potable AWSS will be dependent on the length of the Potable AWSS pipeline constructed, but is anticipated to be approximately 5 valves.

10) Are there other cities that have implemented a Potable AWSS? Or do other cities utilize systems similar to the existing AWSS?

Only one other city in the world, Vancouver, B.C. Canada, has been identified as having an isolated secondary firefighting system similar to the existing AWSS. Vancouver's system is less than 10 miles in length, while ours has over 135 miles.

To our knowledge, all other cities rely on their low-pressure potable water system and hydrants for fire-fighting. In Japan, a country that has similar seismic risk to that of San Francisco, cities utilize a system similar to the proposed Potable AWSS. The Japanese system is designed similar to our proposed Potable AWSS – for fighting a large fire after an earthquake, seismically-reliable water transmission mains and hydrants are isolated from the rest of the distribution system using seismically-reliable valves. This allows the Japanese's seismically reliable mains to be increased in pressure and used for fire-fighting. After the fires are suppressed, the Japanese system is used to provide drinking water to residents and businesses.

Recently a team of Japanese water engineers came to San Francisco to showcase the success of their piping system and their experience using Kubota pipes to SFPUC and SFFD staff. The Japanese team highlighted the success of their system and its piping in its utilization after earthquakes to fight fires.

Japan's successful implementation and use of a system similar to the proposed Potable AWSS showcases that the approach and technology do work in fighting fires after a major earthquake.

If the SFPUC is proposing to fill the Potable AWSS from Sunset Reservoir, how much water is in Sunset Reservoir?

The North and South Basins have a combined capacity of 176 million gallons. The North Basin, with a capacity of 90 million gallons, will be connected to the Potable AWSS. The North Basin recently underwent a $64 million seismic upgrade, and is designed to withstand a 7.9 San Andreas Fault earthquake. It can be isolated from the South Basin, and therefore all 90 million gallons could be used for firefighting purposes.

Can Sunset Reservoir provide enough water for SFFD and civilian use during a fire? How long will the water in Sunset Reservoir last if the reservoir is unable to be re-filled by the SFPUC's Hetch Hetchy Water System, the SFFD is utilizing the Potable AWSS to fight a fire, and civilians are utilizing the reservoir?

If firefighting requires a flow of 14,000 gallons per minute for the Sunset and Richmond districts, the 90 million gallon water supply in the North Basin of Sunset Reservoir will last for 4.5 days. This assumes that no additional water is added from the Hetch Hetchy Water System, which is **very** unlikely. Please see question #12 for additional info.

During an emergency situation, the South basin of Sunset Reservoir will be isolated from the North Basin, allowing the North Basin to be used solely for firefighting purposes. The 86 million gallon South Basin will still be connected to the City's low-pressure drinking water distribution piping system so that residents and businesses can receive drinking water while fires are being fought. In an Earthquake situation, residents and businesses may not receive continuous drinking water from the South Basin as fires are being fought, if there are breaks and/or leaks in the low-pressure drinking water pipes that connect to the South Basin. After the fires are put out, the Potable AWSS, connected to the North Basin, will be able to provide drinking water to the Sunset and Richmond Districts, even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

Will Sunset Reservoir be able to function after an earthquake? How long will it take for the water supplying Sunset Reservoir to arrive to the reservoir if there is a major earthquake?

In 2008, seismic improvements to the North Basin of Sunset Reservoir were completed for $64 million under the SFPUC's Water System Improvement Program (WSIP). Also under the WSIP, seismic improvements were made on the pipelines leading to Sunset Reservoir. **Thus, it is anticipated that the reservoir can be replenished from the Hetch Hetchy Water System within 24 hours of a major seismic event. Therefore, the Hetch Hetchy Water System will be able to re-fill the North Basin of the Sunset Reservoir prior to the Potable AWSS draining it after 4.5 days of use.**

The Hetch Hetchy Water System consists of 9 reservoirs, capable of supplying up to 265 million gallons of water per day. The WSIP includes $4.8 billion in upgrades to the system, increasing its seismic reliability and ability to provide water to the Bay Area after a large earthquake.

The Pacific Ocean is right next to the Westside of San Francisco. Why aren't we filling the Potable AWSS from there? Doesn't the AWSS use Bay Water?

The primary water source for the existing AWSS is the 10 million gallon Twin Peaks Reservoir, 0.5 million gallon Ashbury Heights Tank, and 0.75 million gallon Jones Street Tank. As part of the AWSS bond-funded projects, the Summit Reservoir, with its 11 million gallons of storage, can now be better used by the AWSS. This reservoir serves as a back-up, and would only be utilized by the AWSS during a large fire.

If additional water sources are needed, there are 2 seawater pump stations on the east side of San Francisco that can be utilized to supply a back-up water supply to the AWSS. There have been no known uses of these 2 stations during a fire since their installation in the early 1900s.

The Sunset Reservoir North Basin, with its large capacity and seismic reliability, provides an excellent, existing supply that can be used for the proposed Potable AWSS at no additional cost to rate payers. This reservoir is nine times larger than the existing Twin Peaks reservoir, the primary source utilized by the AWSS.

In the future, an existing SFPUC pump station at Lake Merced will be modified to pump Lake Merced water into new AWSS pipelines that will be installed by the Park Merced development project. Eventually, the Park Merced AWSS pipeline could be connected to the existing AWSS pipeline near Ocean Avenue. Current work will connect the 140 million gallon University Mound Reservoir to the existing AWSS.

The SFPUC is also analyzing new seawater pump stations that could be developed along Ocean Beach and by Hunters Point Shipyard, and will provide updates to the public as the analysis is completed. These future pump stations could serve as back-up supplies for the AWSS and Potable AWSS. Please note that the Potable AWSS would have to be converted to an AWSS if seawater was used, which would cause the system to lose the benefit of being a seismically reliable potable water distribution system for the Sunset and Richmond Districts.

16) How long will it take to install the Potable AWSS in the Sunset and Richmond District? I want fire suppression in the Westside of San Francisco ASAP.

The Potable AWSS is in the planning phase. Pipeline construction could begin in 2019 if the Management Oversite Committee gives direction to proceed with this project. SFPUC is requesting approval for funding of one mile of pipeline per year at $10 million per mile. Depending on the final length of Potable AWSS pipeline, the construction could be completed in four to eight years. A four-mile pipeline would take four years, while an eight-mile pipeline would take eight years. Each mile of pipeline installed provides significantly greater firefighting protection.

Please note that because the Potable AWSS option provides potable water benefits to the Sunset and Richmond Districts, bond funding **and** SFPUC rate payer funds could be used to pay for its implementation.

The same is not true if a traditional AWSS is deployed in the Sunset and Richmond Districts. Traditional AWSS systems can only utilize bond funding. Due to this distinction, a traditional AWSS would likely have a longer implementation timeline than a Potable AWSS because there is not enough bond funding in place to complete a traditional AWSS at this time. A Potable AWSS project could begin implementation more quickly using SFPUC rate payer funds.

18) How do population growth and new buildings affect firefighting reliability, and will AWSS be expanded to growing areas of San Francisco, such as new development areas in the east and southeast areas of San Francisco?

As new developments and population growth occur in San Francisco, the water required for firefighting to address post-earthquake fires may change. SFPUC is modelling the effects of new developments on AWSS capacity requirements, both within the new developments and in the City as a whole. The SFPUC and SFFD are working together to specify new AWSS piping and hydrants required within the new developments. Additionally, developers are required to contribute financing towards, or construct, AWSS facilities such as pipelines or pump stations, for additional firefighting needs. These requirements are specified in the Development Agreements approved by the Board of Supervisors for new, large development projects.

Appendix O

Project Name	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract
Cisterns	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**30**	**30**	
Physical Plant	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**4**	**10**	
Ashbury Tank									1		
Jones Street Tank									1		
Lake Merced Pumping Station - conventional AWSS	1										
Lake Merced Pumping Station - potable AWSS	1										
Pumping Station 1				1							
Pumping Station 2				1							
Twin Peaks Reservoir									1		
Twin Peaks Reservoir Joint Sealing									1		
Sunset Reservoir Pumping Station - potable AWSS	1										
University Mound Pumping Station - conventional AWSS								1			
Pipelines & Tunnels	**1**	**2**	**2**	**3**	**0**	**0**	**5**	**6**	**9**	**28**	
4th Street Connection							1				
Clarendon Supply			1								
Control System									1		
Fillmore & Haight								1			✓
Fort Mason Pier 2 Seawater Manifold								1			
Jones Street Tank Valves									1		
Pipeline Repairs									1		
Planning Study (CS-199)									1		
Pumping Station 1 Tunnel								1			
Seawater Fireboat Manifolds Evaluation									1		
Seawater Suction Connections									1		
Street Valve Motorization								1			
Twin Peaks Reservoir 16" Supply									1		
19th Avenue Pipeline			1								✓
Ashbury Bypass Pipeline				1							✓
Candlestick Point - Carroll Avenue									1		
Columbus & Green Pipeline									1		✓
FWSS - Lake Merced							1				
FWSS - McLaren Park Tanks							1				
FWSS - Street Crossings							1				
FWSS - Sunset Reservoir							1				
Ingleside Pipeline								1			
Irving Street Pipeline				1							✓
Lake Merced Pipeline		1									
Mariposa TFB Pipeline				1							
TFB Mission Rock - South Pipeline		1									
Westside Potable AWSS Pipeline	1										
University Mound East Pipeline								1			
Assessments	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**12**	
Ashbury Heights Valve House Evaluation									1		
Jones Street Tank Generator Foundation Evaluation									1		
Jones Street Tank Retaining Walls Assessment									1		
Jones Street Tank Valve House Evaluation									1		
ESER 2014 Project Recommendations									1		
Pipeline Network Surge Analysis									1		
Pumping Station 1 Foundation & Well Evaluation									1		
Pumping Station 1 Tunnel Evaluation (PS1 to bay)									1		
Pumping Station 2 Discharge Tunnels Evaluation									1		
Pumping Station 2 Well Evaluation									1		
Twin Peaks Reservoir Forebays Evaluation									1		
Twin Peaks Reservoir Tunnel Evaluation									1		
	4	2	2	5	0	0	5	7	55	80	
	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract

Appendix P

Candidate EFWS Projects

5/8/2019

Projects	Project Cost ($M) (2018 $)	No. of FRA's Directly Benefited	Hydraulic Power (MW)	Project Cost/MW ($M)	Scaling Factor to Lowest $/MW
Pipeline Projects					
1 Conv. AWSS PL - Diamond Street	4	1	0.7	6	1.0
2 Westside Seawater Supply PL			TBD		
3 Conv. AWSS PL - Lake Merced	4	1	0.1	25	4.2
4 Conv. AWSS PL - College Hill Supply	34	0	0.8	43	7.1
5 PEFWS	195	8	4.1	44	7.3
6 Conv. AWSS PL - Ingleside (Phase 1)	6	1	0.1	53	8.8
7 Conv. AWSS PL - Stanford Heights Supply	18	0	0.3	60	10.1
8 Conv. AWSS PL - University Mound East	23	4	0.4	67	11.2
9 Conv. AWSS PL - Ingleside (Phase 2)	14	1	0.2	78	13.0
10 Conv. AWSS PL - University Mound West	19	2	0.2	112	18.7
Subtotal Pipeline Projects	**317**		**6.8**		
Supply Projects					
1 Potable EFWS - Lake Merced PS	40	8	4.6	9	1.3
2 Conv. AWSS Lake Merced PS	10	2	1.5	7	1.0
3 Potable EFWS - Sunset PS	34	8	4.6	7	1.1
4 Conv. AWSS University Mound PS	20	10	2.6	8	1.2
5 Conv. AWSS Manifold - Pier 33-1/2	5	0	0.4	13	1.9
6 PS1 Well	2	0	0.1	13	2.1
7 Westside Seawater PS			TBD		
8 Conv. AWSS Manifold - Fort Mason Pier 1	8	0	0.4	21	3.1
9 Conv. AWSS College Hill Supply PS	25	0	1.0	25	3.8
10 Twin Peaks Forebays	6	0	0.2	26	3.9
11 Twin Peaks Tunnel	8	0	0.2	34	5.2
12 PS1 Tunnel (Phases 1 and 2)	13	0	0.3	43	6.6
13 Conv. AWSS Stanford Heights Supply PS	26	0	0.6	43	6.6
14 PS2 Discharge Tunnels	5	0	0.1	67	10.3
15 PS2 Well	4	0	0.04	89	13.7
Subtotal Supply Projects	**206**		**16.8**		
Infirm Zone Projects					
1 Conv. AWSS PLs - Infirm Zone 7	16	1	0.21	79	1.0
2 Conv. AWSS PLs - Infirm Zone 9	10	1	0.03	320	4.1
3 Conv. AWSS PLs - Infirm Zone 3, 4, 5	33	3	0.05	666	8.5
4 Conv. AWSS PLs - Infirm Zone 1, 2	32	2	0.04	790	10.1
5 Conv. AWSS PLs - Infirm Zone 6	18	1	0.00		
6 Conv. AWSS PLs - Infirm Zone 8	7	1	0.00		
7 Conv. AWSS PLs - Infirm Zone 10	19	1	0.00		
Subtotal Infirm Zone Projects	**135**		**0.3**		
Other Projects					
1 Conv. AWSS PL - PIPE - Bryant & 11th	16	0	0.15	104	1
2 Conv. AWSS PL - PIPE - Dolores & 20th	9	0	0.05	197	1.9
3 Conv. AWSS PL - PIPE - Brannan St.	36	0	0.04	953	9.2
4 Conv. AWSS PL - PIPE - Market St.	28	0	0.03	871	8.4
5 Ashbury Valve House	5	0			
6 Jones St Generator Foundation	1	0			
7 Jones St Valve House	5	0			
8 PS2 Remote Operation and Engine Repl.	12	0			
9 Miscellaneous Repairs	15	0			
10 Conv. AWSS PL - Surge Protection	4	0			
11 Conv. AWSS PL - Valve Renovation	6	0			
Subtotal Other Projects	**136**		**0.3**		
Development Projects					
1 Potrero PL	14	1			
2 Southern Area Supply Projects	166	5			
Subtotal Development Projects	**180**				
Grand Total	**974**		**19**		

1) MW=Hydraulic power (MW)
(1 MW = 1,341 hp)
2) S=Scaling factor to lowest $/MW

Appendix Q

Fire Dept.'s Ace in the Hole

By Jim Castleberry

The night of the Oct. 17 earthquake was not the first time the San Francisco Fire Department had to call on its Portable Water Supply System, but it was by far the most important.

When firefighters responded to a blaze in the Marina District, they were horrified to learn that *all the water lines in a 40 square block area surrounding the fire were broken and useless.*

With no water pressure, firefighters could only watch as the fire raged out of control and threatened to explode into the largest blaze in the city since 1906.

But the city had one more card to play – its ace in the hole.

Division Chief Harry Brophy issued the call for the Fireboat Phoenix and the department's Portable Water Supply System (PWSS).

For Assistant Chief Frank Blackburn, who developed the PWSS, and his fellow firefighters, it was the test they had been waiting for. The one that would determine once and for all if the PWSS, hailed as ingenious by some and a boondoggle by others, really worked. "I told the guys that this was the Super Bowl," Blackburn said.

Fortunately for the city, the PWSS performed perfectly.

As the Phoenix pumped water from the Bay, firefighters set up portable hydrants on Divisadero Street that allowed them to stretch hoses all the way to the fire at Beach Street.

Within an hour after the system was hooked up, the fire had been brought under control.

San Francisco's Board of Supervisors rewarded Blackburn with a commendation, thanking him not only for the development of the system but his quick work in putting it to use on Oct. 17.

"Without those portable hydrants, along with the fireboat, the city probably would have burned to the ground," Supervisor Terrance Hallinan said. "Blackburn knew where all the hydrants were and as soon as it hit, he rounded them up and set them into operation. It was a key to turning that whole situation around."

The key to the PWSS is the portable hydrant designed by Blackburn from old Gleeson pressure-reducing valves and other spare parts lying around the department's repair shop.

Using the hydrants, firefighters can pump from the Bay, a lake or underground cistern and lay a grid of hose covering several blocks.

The portable hydrants not only allow water pressure to be maintained, they also let firefighters hook up pumper trucks or fire hoses along the line so fires in multiple locations can be battled.

"Say there was a fire on Van Ness Avenue and all the water mains were broken," Blackburn said. "The PWSS would let you pump water from the Bay, all the way up Van Ness. People say it can't work, but it does. We proved it on Oct. 17."

Blackburn didn't start working on the portable hydrants and PWSS until 1984. By 1985 a prototype was ready and they were in regular use by 1986.

The PWSS helped put out a five alarm fire at First and Townsend street in 1987 and was also used at Hetch Hetchy later that year to protect buildings threatened by a fire burning in Yosemite National Forest.

"We drafted water from the Tuolumne River for that one," Blackburn said. "It's amazing. All you need is a body of water."

"It's something that San Francisco should really be proud of," said Dr. Charles Scawthorn, a researcher who has done extensive study of the risk posed to San Francisco by fire.

In 1987 Scawthorn wrote a report for the insurance industry on the conflagration risk in San Francisco following a major earthquake similar to 1906.

His report foresees widespread destruction with billions of dollars in property losses and dozens of major fires – similar in size to the Marina fire – after a magnitude 8.3 or larger quake.

"Everything that happened on Oct. 17 confirmed my findings," he said. "But the PWSS is obviously going to greatly improve the chance of the city surviving 'The Big One.' It won't save it entirely but at least we'll be able to limit the losses."

The Portable Water Supply System includes:

-- Four hose wagons that carry 4,000 to 5,000 feet of large, five inch diameter hose that connect to the portable hydrants (normal firehose is only three inches in diameter.

-- Underground cisterns located throughout the northern and eastern sections of the city that can be filled with water to supply trucks along the way.

-- Portable hydrants that allow water to flow freely for long distances at a very high pressure.

Scawthorn recommends a large-scale expansion of the PWSS.

"If there are only four hose wagons, you can only fight fires in four locations," Scawthorn said. "After a big quake there will be fires breaking out all over the city."

The Fire Commission has indicated its desire to expand the system and cleared the way for building of more cisterns in the outer Sunset and Richmond residential neighborhoods.

Plans are also underway to purchase more large-diameter hose, if the money can be found.

Blackburn calls it the best defense a city like San Francisco can have against fire following an earthquake.

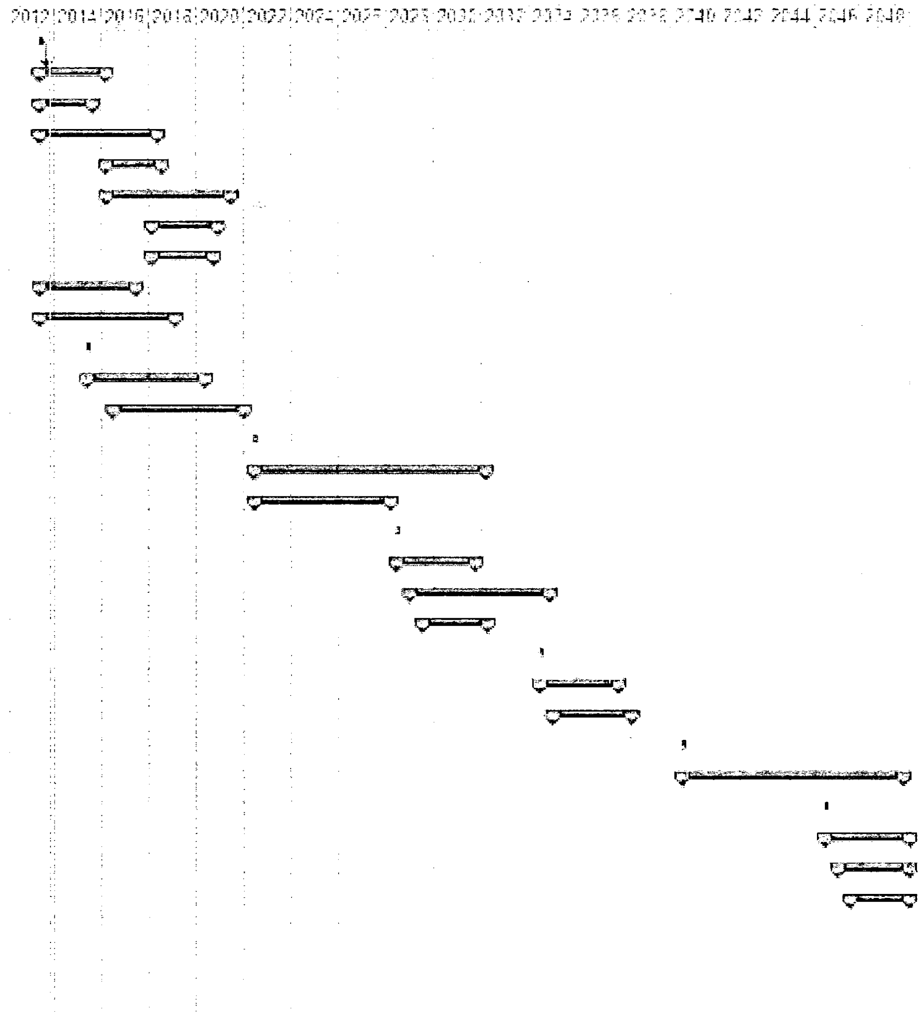
"When a major quake occurs and water mains are broken, the answer is the PWSS," he said. "If you don't have it, you won't put the fires out."

1990 article on the Portable Water Supply System, an adjunct to the AWSS, and its use during the post-earthquake fires in October 1989.

Appendix R

Figure 5-1. Preferred Alternative Planning Level Schedule

	Task Name	Duration	Start	Finish
1	Alternative B	1 day	Mon 6/3/13	Mon 6/3/13
2	Motorization & addition of seism	720 days	Tue 6/4/13	Mon 3/7/16
[illegible]	4th Street Hose	576 days	Tue 6/4/13	Tue 8/18/15
[illegible]	PS1 Tunnel upgrade	1236 days	Tue 6/4/13	Tue 5/22/18
[illegible]	Jones St. Tank Bypass Valves	624 days	Tue 3/8/16	Fri 7/27/18
[illegible]	Repair suction connections	1372 days	Tue 3/8/16	Wed 6/9/21
[illegible]	SCADA improvements	720 days	Fri 2/16/18	Thu 11/19/20
[illegible]	FB Manifold R&R	672 days	Fri 2/16/18	Mon 9/14/20
[illegible]	Pipe Investigation and Repair	1050 days	Tue 6/4/13	Mon 6/12/17
[illegible]	Sutro Connection and PS	1400 days	Tue 6/4/13	Thu 2/14/19
[illegible]	2014 Bond	1 day?	Mon 6/1/15	Mon 6/1/15
[illegible]	Reliability Upgrades at Facilities	1236 days	Tue 6/2/15	Tue 5/19/20
[illegible]	Cistern Construct 46 New Cister	1432 days	Fri 7/8/16	Mon 1/3/22
47	2021 Bond	1 day?	Wed 6/1/22	Wed 6/1/22
[illegible]	Pipeline Replacement Program	2548 days	Thu 6/2/22	Mon 3/8/32
[illegible]	Silver Extension	1638 days	Thu 6/2/22	Mon 3/13/28
[illegible]	2027 Bond	1 day?	Thu 6/1/28	Thu 6/1/28
[illegible]	University Mound Connection an	864 days	Fri 6/2/28	Wed 9/24/31
[illegible]	Sunset Extension	1528 days	Thu 12/21/28	Mon 10/30/34
[illegible]	Sunset Rezoning	708 days	Wed 7/11/29	Fri 3/26/32
[illegible]	2033 Bond	1 day?	Thu 6/1/34	Thu 6/1/34
[illegible]	Lake Merced Pump Station	854 days	Fri 6/2/34	Wed 9/20/37
[illegible]	Sunset Connection and PS	854 days	Thu 12/21/34	Tue 4/12/38
[illegible]	2039 Bond	1 day?	Fri 6/1/40	Fri 6/1/40
[illegible]	Pipeline Replacement Program	2432 days	Mon 6/4/40	Tue 9/28/49
[illegible]	2045 Bond	1 day?	Fri 6/1/46	Fri 6/1/46
[illegible]	Richmond Extension	935 days	Mon 6/4/46	Fri 12/31/49
[illegible]	Alemany Extension	791 days	Fri 12/21/46	Fri 12/31/49
[illegible]	Geneva Extension	647 days	Thu 7/11/47	Fri 12/31/49



Carroll, John (BOS)

From:	Carroll, John (BOS)
Sent:	Thursday, July 25, 2019 3:49 PM
To:	BOS-Supervisors
Cc:	BOS-Legislative Aides; 'Calvillo, Angela (angela.calvillo@sfgov.org)'; Somera, Alisa (BOS); Civil Grand Jury; Kittler, Sophia (MYR); Karunaratne, Kanishka (MYR); Power, Andres (MYR); Ma, Sally (MYR); Peacock, Rebecca (MYR); Rosenfield, Ben (CON); Rydstrom, Todd (CON); Stevenson, Peg (CON); Lediju, Tonia (CON); Newman, Debra; Campbell, Severin (BUD); Holober, Reuben (BUD); Millman Tell, Jennifer (BUD); Rasha Harvey; Lori Campbell; Kelly, Naomi (ADM); Khaw, Lynn (ADM); Strong, Brian (ADM); Raphael, Deborah (ENV); Gallotta, Peter (ENV); Sheehan, Charles (ENV); Nicholson, Jeanine (FIR); Ludwig, Theresa (FIR); Nakajo, Stephen (FIR); Conefrey, Maureen (FIR); Kelly, Jr, Harlan (PUC); Ellis, Juliet (PUC); Scarpulla, John; Whitmore, Christopher (PUC); Caen, Ann Moller (PUC); Hood, Donna (PUC); Mchugh, Eileen (BOS); GIVNER, JON (CAT)
Subject:	2018-2019 Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System
Categories:	190786, 190785

Supervisors:

Please find linked below the 2018-2019 Civil Grand Jury report, entitled: **Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System,** as well as a press release memo from the Civil Grand Jury and an informational memo from the Clerk of the Board.

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Civil Grand Jury Press Release - July 17, 2019

Clerk of the Board Memo - July 24, 2019

I invite you to review the entire matter on our Legislative Research Center by following the link below:

Board of Supervisors File No. 190785

Thank you,

John Carroll
Assistant Clerk
Board of Supervisors
San Francisco City Hall, Room 244
San Francisco, CA 94102
(415) 554-4445

Click here to complete a Board of Supervisors Customer Service Satisfaction form.

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

MEMORANDUM

Date: July 24, 2019

To: Honorable Members, Board of Supervisors

From: Angela Calvillo, Clerk of the Board

Subject: 2018-2019 CIVIL GRAND JURY REPORT - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 17, 2019, the 2018-2019 Civil Grand Jury issued a press release, publicly announcing issuance of their report, entitled:

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 18, 2019, the Civil Grand Jury issued an updated report, including appendices which we inadvertently omitted from the July 17 public release.

Pursuant to California Penal Code, Sections 933 and 933.05, the Board must:

1. Respond to the report within 90 days of receipt, or no later than October 15, 2019; and
2. For each finding the Department response shall:
   - agree with the finding; or
   - disagree with the finding, wholly or partially, and explain why.
3. For each recommendation the Department shall report that:
   - the recommendation has been implemented, with a summary of how it was implemented;
   - the recommendation has not been, but will be, implemented in the future, with a timeframe for implementation;
   - the recommendation requires further analysis, with an explanation of the scope of the analysis and timeframe of no more than six months from the date of release; or
   - the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Pursuant to San Francisco Administrative Code, Section 2.10, in coordination with the Committee Chair, the Clerk will schedule a public hearing before the Government Audit and Oversight Committee to allow the Board the necessary time to review and formally respond to the findings and recommendations.

Continues on following page

The Budget and Legislative Analyst will prepare a resolution, outlining the findings and recommendations for the Committee's consideration, to be heard at the same time as the hearing on the report. These matters are anticipated for hearing in Government Audit and Oversight during a regular committee meeting in September 2019.

If you have any questions, please contact John Carroll, Assistant Clerk, at (415) 554 4445.

Attachments: July 17, 2019 Press Release; and
July 18, 2019 Updated Report: Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

FOR IMMEDIATE RELEASE

Contacts: Rasha Harvey, Foreperson, 415-716-8258
Stephen Garber, Committee Chairperson, 510-682-4693

***** PRESS RELEASE *****

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR EMERGENCY FIREFIGHTING WATER SYSTEM

San Francisco, CA, July 17, 2019 – San Francisco is notoriously vulnerable to fires following a major earthquake. Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system -- that provides excellent firefighting protection to parts of the City. However, the Civil Grand Jury found that large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS, and would be particularly vulnerable to fire damage when the next major earthquake strikes.

City leaders have known about this deficiency for decades, but have yet to develop concrete plans or a timeline to provide a robust emergency firefighting water supply for all neighborhoods. In 2014, the US Geological Survey estimated that there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043. Plans to develop a seismically safe high-pressure AWSS for the western portion of the City are now moving forward. However, at the City's current pace and funding levels, expansion of AWSS protections to inadequately protected neighborhoods will not be completed for 35 years or more – well after the USGS predicts that one or more major earthquakes will strike. The Civil Grand Jury, therefore, recommends that, by the end of 2020, the City present a detailed plan to extend AWSS protections to all neighborhoods, with an accelerated completion date of no later than 2034.

As an interim measure, the Grand Jury strongly recommends that the Mayor and the Board of Supervisors approve the San Francisco Fire Department's (SFFD) request to replace and expand its portable water supply system (PWSS). Comprised of specially equipped trucks ("hose tenders"), the PWSS can distribute pressurized water from many sources for long distances, and can be built and operational in one to two years. The Grand Jury recommends that these new PWSS hose tenders be strategically placed in Districts 1, 4, 7, and 11 -- neighborhoods lacking in AWSS protections. Although the Mayor's draft budget includes funds for 4 new hose tenders, this is barely sufficient to replace the current inventory of 5 tenders, all of which are past their useful lives.

The Grand Jury also recommends that the San Francisco Public Utilities Commission and the SFFD jointly develop "best practices" to ensure the proper maintenance of all AWSS assets, and that these agencies adopt and implement annual emergency response exercises, which include simulated earthquake drills using both AWSS and PWSS assets.

ACT NOW BEFORE IT IS TOO LATE

Experts tell us that San Francisco is overdue for another major earthquake like the one that devastated the City in 1906. Nevertheless, City officials have not prioritized plans to expand the high-pressure emergency firefighting water supply to all neighborhoods. This is a problem that threatens the lives and property of over one-third of our City's residents. City officials should make the expansion of emergency firefighting protections to all San Franciscans a matter of high priority, before it is too late.

Civil Grand Jury reports may be viewed online at http://civilgrandjury.sfgov.org/report.html.

###

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]		

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Angela Calvillo
Clerk of the San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Calvillo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Budget and Legislative Analyst
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Sir or Madam,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Sandra Lee Fewer
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Fewer,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RL H

Rasha Harvey, Foreperson

July 15, 2019

Catherine Stefani
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Stefani,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

R H

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Aaron Peskin
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Peskin,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Gordon Mar
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mar,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Vallie Brown
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Brown,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Matt Haney
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Haney,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Norman Yee
President
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear President Yee,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

R H

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Rafael Mandelman
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mandelman,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Hillary Ronen
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Ronen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Shamann Walton
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Walton,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ahsha Safai
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Safai,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Naomi M. Kelly
City Administrator
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Brian Strong
Chief Resilience Officer
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mr. Strong,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Debbie Raphael
Director
San Francisco Department of the Environment
1455 Market Street, Suite 1200
San Francisco, CA 94103

Dear Ms. Raphael,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Jeanine Nicholson
Fire Chief
San Francisco Fire Department
698 Second Street
San Francisco, CA 94107

Dear Chief Nicholson,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Stephen Nakajo
President
San Francisco Fire Commission
1765 Sutter Street
San Francisco, CA 94115

Dear President Nakajo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

The Honorable London Breed
Mayor of San Francisco
City Hall, Room 200
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mayor Breed,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Harlan L. Kelly, Jr.
General Manager
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear General Manager Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ann Moller Caen
President
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear President Caen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

TO THE BOARD OF SUPERVISORS
FROM JAMES DALESSANDRO -
September 19, 2019: File # #190786

AUTHOR OF "1906" and FILM MAKER OF "THE DAMNEDEST, FINEST RUINS"

DEAR SUPERVISORS: At five o'clock on the afternoon of April 19, 1906 - 36 hours after the catastrophic San Andreas fault rupture - 5 ships of the U.S. Navy's Pacific Squadron arrived at the Golden Gate to face a mountain of flames 1,500 feet high.

Utilizing their ships' massive steam pumps and an unlimited supply of saltwater, they stopped the fire along the entire Embarcadero – crucial to our rebuilding. They stopped the flames from leaping Van Ness Avenue, sparing the scant housing stock of Pacific Heights, the Fillmore, Sunset and Richmond Districts. They evacuated 100,000 desperate people on the waterfront. Over 38 hours, they pumped several hundred MILLION gallons of saltwater to check the fire's spread and save untold numbers of lives.

On October 17, 1989, following the Loma Prieta Earthquake, another naval vessel – our Fireboat Phoenix - pumped salt water onto the Marina fire for 14 hours, delivering 5 ½ MILLION gallons of salt water. It almost certainly prevented a repeat of 1906. Think of that for a moment, please - 5 ½ MILLION GALLONS OF SALT WATER to stop a single fire of only ¼ of a city block. If they had not stopped it there – where and how would they have stopped it?

So where are we today?

Despite 10's of millions of dollars from bond issues, provided overwhelmingly by San Francisco voters over the previous decades, 15 neighborhoods – 400,000 citizens – have no auxiliary, high-pressure water system to save homes, business, or lives. Why? Because the Public Utility Commission, which now controls the Auxiliary Water Supply System, has proposed one preposterous alternative after another to avoid expanding the AWSS. To further exacerbate our jeopardy, they have failed to maintain the EXISTING AWSS to where one seriously doubts its ability to function in an emergency.

Instead of expanding the AWSS, the PUC first proposed to buy 15 miles of cumbersome 12-inch hose. That was to be rolled out by the 24 on duty firefighters in the Sunset and Richmond Districts BEFORE they started fighting fires or rescuing citizens. Supervisor Peskin and others stopped that absurdity.

So now the PUC – instead of expanding the High Pressure SALTWATER SYSTEM with 3 pumping stations along the Bay and Pacific Ocean – is proposing that we co-mingle the POTABLE DRINKING WATER of the Sunset Reservoir with the brackish, POLLUTED WATER OF LAKE MERCED. The minute the Lake Merced Water enters

the MUNICIPAL WATER SUPPLY SYSTEM at least 400,000 people will be candidates for a wide variety of water born diseases.

Perhaps members of the PUC could drink unfiltered Lake Merced water for a week or two and let us all know how they fare? Or tell us how they plan to defend the massive lawsuits by our neighbors in the South Bay – who own 2/3rds of Sunset Reservoir's drinking water.

As you sit here today, the massive diesel pumping stations that supply the EXISTING AWSS – one station at Fort Mason, the other directly beneath the office of the Fire Chief on Townsend Street – are without an attendant capable of activating the system to supply salt water to the downtown's EXISTING high pressure hydrants.

The other parts of the EXISTING system, the levers and gates inside Jones Street on Nob Hill, which control nearly 12 million gallons of water from the Twin Peaks and Ashbury Heights Tanks – has not had an attendant on site in more than 20 years.

The PUC allegedly has someone somewhere who will control those massive Jones Street gates and valves and high-pressure water flow by means of a laptop computer. It is unclear what he or she knows about fire fighting, or how he or she would receive information on where that water is needed. It is also unclear if that system can deliver water, since some firefighters have stated the lack of regular flushing and maintenance has left hydrants clogged with sediment.

And now, our Mayor, a former Fire Commissioner, has cut $100,000 from the NERT budget – Neighborhood Emergency Response Team - curtailing the training of volunteers willing to risk their lives to rescue their neighbors.

I urge the Board of Supervisors to immediately appoint a Blue Ribbon Commission comprised of people who understand the science of fire suppression, and care about what happens to this city and its citizens. A Commission who will challenge the Public Utilities Commission and over ride the unconscionable support from some, but not all senior members of the Fire Department, past and present. The neglect and delays have pushed this city, its citizens and visitors to the brink of catastrophe.

The recent findings of the 2019 Civil Grand Jury, crying ACT NOW, come with an ominous footnote. Their findings echo those of the 2003 Civil Grand Jury. And of bond issues dating back to 1986 and 1908. The neglect of our current system by the PUC, and their preposterous ideas to further endanger us all, must be stopped.

It appears, dear Board, that the task is yours as the last vestige of hope and sanity.

James Dalessandro

Print Form

Introduction Form

By a Member of the Board of Supervisors or the Mayor

Time stamp
or meeting date

I hereby submit the following item for introduction (select only one):

- ☐ 1. For reference to Committee. (An Ordinance, Resolution, Motion, or Charter Amendment)
- ☐ 2. Request for next printed agenda Without Reference to Committee.
- ☒ 3. Request for hearing on a subject matter at Committee.
- ☐ 4. Request for letter beginning "Supervisor [ ] inquires"
- ☐ 5. City Attorney request.
- ☐ 6. Call File No. [ ] from Committee.
- ☐ 7. Budget Analyst request (attach written motion).
- ☐ 8. Substitute Legislation File No. [ ]
- ☐ 9. Reactivate File No. [ ]
- ☐ 10. Question(s) submitted for Mayoral Appearance before the BOS on [ ]

Please check the appropriate boxes. The proposed legislation should be forwarded to the following:

☐ Small Business Commission ☐ Youth Commission ☐ Ethics Commission

☐ Planning Commission ☐ Building Inspection Commission

Note: For the Imperative Agenda (a resolution not on the printed agenda), use a Imperative Form.

Sponsor(s):

Clerk of the Board

Subject:

Hearing - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

The text is listed below or attached:

Hearing on the recently-published 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Signature of Sponsoring Supervisor: ____________________

For Clerk's Use Only:

190786

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

DATE: June 25, 2020

TO: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Harlan L. Kelly Jr., General Manager of the SFPUC HK
Jeanine Nicholson, Chief of the Department, San Francisco Fire Department

SUBJECT: Fiscal Year 2019-2020 Annual Emergency Firefighting Water System Report

---

Pursuant to Resolution No. 484-19, the San Francisco Public Utilities Commission and San Francisco Fire Department hereby provide the following report on the City's Emergency Firefighting Water System (EFWS). Resolution No. 484-19 urges the departments provide a consolidated annual report to the Board of Supervisors, "...on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan."

This report addresses the information requested in Resolution No. 484-19 and provides an update on the City's EFWS preparedness.

Program Background

The San Francisco EFWS is vital for protecting against the loss of life resulting from multi-alarm fires, as well as the loss of homes and businesses by providing an additional layer of fire protection. The system is used throughout the year for the suppression of multiple-alarm fires. The system delivers water at high pressure to the SFFD for firefighting purposes. The primary source of water is the SFPUC's Hetch Hetchy Regional Water System, which supplies water to one reservoir and two storage tanks. The water is subsequently supplied from the reservoirs and tanks into 135 miles of pipelines. The secondary source of water for the EFWS is the San Francisco Bay. There are two seawater pump stations that can supply seawater into the pipelines, as well as 35 suction connections along the northeastern waterfront, which allow fire engines to pump water from the Bay. Finally, two fireboats are available to supply seawater by pumping into any of the five manifolds connected to pipelines.

In 2010, 2014, and 2020, San Francisco voters approved three Earthquake Safety and Emergency Response (ESER) General Obligation Bonds, allowing

the City to make critical public safety investments and upgrades to emergency response facilities and infrastructure, including the EFWS.

With the passage of each ESER bond, the SFPUC, SFFD, Public Works, and the Office of Resilience and Capital Planning in the City Administrator's Office have made it a high priority to evaluate, plan, repair, upgrade, and expand EFWS infrastructure throughout San Francisco. In addition to ESER funded upgrades, large development projects in San Francisco have also installed EFWS infrastructure within and adjacent to project boundaries.

2020 Earthquake Safety and Emergency Response Bonds

In March of this year, San Francisco voters approved the 2020 Earthquake Safety and Emergency Response General Obligation Bond. That bond's programming included $153.5 million for the Emergency Firefighting Water System. That funding will be allocated to replace, extend and seismically upgrade system components to increase the ability to provide adequate water throughout the City for firefighting following a major earthquake and during multiple-alarm fires.

With the ESER funding, many upgrades will focus on improving EFWS capabilities in the City's western neighborhoods. The results and recommendations of the 2018 *Westside Emergency Firefighting Water System Options Analysis* planning study will help to inform the selection and design of specific projects to be funded through ESER 2020. Upon the completion of required environmental review, construction will proceed for selected projects.

Capital Projects: Fiscal Year 2019 – 2020

During Fiscal Year 2019-2020, ESER bond funds were utilized on a total of 10 capital projects, funding the installation of EFWS infrastructure and/or funding engineering and planning work in advance of installing the infrastructure. Please refer to Table 1 for more information.

Table 1: ESER Bond Funded EFWS Projects

<table>
<tr><th>Project</th><th>Status</th></tr>
<tr><td>Ashbury Bypass EFWS Pipeline</td><td rowspan="4">Completed</td></tr>
<tr><td>Terry Francois & Mariposa EFWS Pipeline</td></tr>
<tr><td>Pump Station No. 1</td></tr>
<tr><td>Irving Street EFWS Pipeline</td></tr>
<tr><td>Pump Station No. 2 Upgrades</td><td>Under Construction</td></tr>
<tr><td>Terry Francois/Mission Rock/Warriors Way EFWS Pipeline</td><td rowspan="3">Construction will begin FY 2020-21</td></tr>
<tr><td>Clarendon Supply EFWS Pipeline</td></tr>
<tr><td>19th Ave. EFWS Pipeline</td></tr>
<tr><td>Potable Emergency Firefighting Water System</td><td>Planning and Design</td></tr>
<tr><td>Street Valve Motorization</td><td>Bidding</td></tr>
</table>

Technical Studies	Continuing
Administration	

<u>Development Projects: Fiscal Year 2019 – 2020</u>
Additionally, the SFPUC and SFFD coordinate with project sponsors of large development projects to ensure the installation of EFWS infrastructure within and adjacent to their respective projects. Please see Table 2 for development projects that installed or committed to install EFWS infrastructure this Fiscal Year.

Table 2: Development Projects: EFWS

Project	Status
Pier 70	Installed EFWS Infrastructure
HopeSF Sunnydale	
Potrero Power Station	EFWS Infrastructure included in Approved Development Agreement.
3333 California	
Balboa Reservoir	EFWS Infrastructure included in Development Agreement (Pending Approval)

<u>Active Fires, Trainings, and Inspections: Fiscal Year 2019-2020</u>
Additionally, the SFFD, SFPUC, and other agencies used EFWS infrastructure for trainings and active fires, performed routine inspections, and held joint meetings to discuss emergency response planning and project priorities. A summary of the SFFD's EFWS activities and partners for Fiscal Year 2019-2020 is provided in Table 3.

Table 3: Summary of SFFD EFWS Activity

Date	Participants	Activity
11/20/2019	**<u>SFFD</u>:** Fireboat St. Francis, E35, E08, E29, B03, D3, ADC Michael Cochrane, Deputy Chief Victor Wyrsch, Water Supply Officer Brent Stuckert, Division of Training Staff and members of the Bureau of Equipment. **<u>SFPUC</u>**: EFWS Superintendents, Utility Plumbers, Hydrant Gatemen, plumbers and members of the engineering Department	***Pier 90 salt-water inlet manifold drill*** The Fireboat St. Francis supplied salt water to a portion of the EFWS that had been isolated by the SFPUC to operate multiple high-pressure hydrants and a deck gun.
12/12/2019	**<u>SFFD</u>:** Deputy Chief Victor Wyrsch, Deputy Chief Jose Velo, Assistant Deputy Chief Dawn DeWitt, Assistant Chief	***Joint Agency Q&A and group discussion*** Improvements made to the EFWS

Date	Participants	Activity
	Brook Baker; Assistant Chief Robert Postel, Water Supply Officer Captain Brent Stuckert, Division of Training Staff and numerous Battalion Chiefs **<u>SFPUC</u>:** Rich Gonzales, Sean Duffy, Kevin O'Connor and Ryan Gabriel.	since the 1989 earthquake, strategies to further improve the system in its current configuration, agency response plans in the event of a large-scale disaster, and interagency drills that will be conducted on a quarterly basis.
02/29/2020	**<u>SFFD</u>:** 4th Alarm Fire at Toland St. / Evans St. **<u>SFPUC</u>**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations for this 4th Alarm Fire
3/03/2020	**<u>SFFD</u>:** E01, E35, B03, Water Supply Officer Captain Stuckert. **<u>SFPUC</u>:** Superintendent Rich Gonzales, Utility Plumbers and Hydrant Gatemen, Superintendent of Facilities Operations Brahman Conci	***Bay Bridge Pump Station and Standpipe drill*** This was a joint operation that required close coordination between the SFFD and the SFPUC and satisfied recommendation R10 of the 2019 Civil Grand Jury Report on the EFWS. The drill simulated a large-scale fire event on the west span of the Bay Bridge that would require more water than the 500 gallons that are carried by a single SFFD engine. This was the first time a drill of this nature has been performed and resulted in new standard operating procedures for disaster events on the Bay Bridge.
05/23/2020	**<u>SFFD:</u>** 4th Alarm Fire at Pier 45 **<u>SFPUC</u>**: Gatemen	***Structure Fire*** EFWS system used for ladder pipe operations and to supply 5" hose provide by the hose tenders. The St. Francis Fireboat was put into operation and saved the historic Liberty Ship SS Jeremiah O'Brien from being destroyed by this 4th Alarm Fire.
10/26/*2019* 11/16/2019 12/21/2019 12/28/2019 01/25/2020	**<u>SFFD</u>:** Multiple engine companies and Battalion Chiefs	***5" Hose drills*** Regularly scheduled drill using 5" hose tenders and high pressure hydrants, ladder pipes and/or

Date	Participants	Activity
02/15/2020 05/04/2020 05/09/2020 05/16/2020		monitor nozzles/deck guns.
In Progress	**SFFD**: Water Supply Officer Captain Brent Stuckert **Rec & Park:** David Iribarne	***Joint Agency Discussion*** SFFD has contacted Rec and Parks asking them to consider adding more hydrants inside Golden Gate Park. The Urban Tree Canopy is now being taken into consideration in the latest Fire Following Earthquake models, and Golden Gate Park has a large amount of both surface and canopy fuel loads.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stucker **Port:** Shannon Alford	***Bay Dredging near salt-water inlet manifold.*** SFFD has been working with the SF Port to schedule dredging adjacent to the salt-water inlet manifold located on piers to ensure the St. Francis fireboat has adequate draft to perform pump operations through a complete 24-hour tidal cycle. SFFD has also requested the area near the Pump Station No. 1 inlet tunnel to be included in Port's dredging boundary. This inlet tunnel must be kept clear to allow the Pump Station to provide seawater to the EFWS.
In Progress	**SFFD:** Water Supply Officer Captain Brent Stuckert, B07, 5" Hosetender **SFPUC:** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineers.	***SFFD-SFPUC Joint 5" Hose Drill*** Preparations have begun for a 5" Hose Tender Drill involving SFFD and SFPUC. SFPUC will assist with measuring exact pressures and water flow in the 5" lines to determine optimal placement of the 5" hose and engines for relay pumping operations. Relay pumping will be required to deliver water long distances and to the higher elevations of San Francisco. These preparations will increase the City's resilience by

Date	Participants	Activity
		mitigating the projected multiple post seismic ignitions. (This drill has been delayed due to the pandemic and will be conducted when normal operations can be resumed.)
In Progress	**<u>SFFD:</u>** Water Supply Officer Captain Brent Stuckert **<u>SFPUC:</u>** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***Bay Suction Connection Inspection Program*** Inspection and maintenance of the 35 Bay Suction Connections that are situated along the San Francisco Waterfront. These connections are used by SFFD engine companies to draft water from the Bay.
In Progress	**<u>SFFD</u>**: SFFD engine companies, Water Supply Officer Captain Stuckert. **<u>SFPUC:</u>** Manager Bill Teahan, Superintendent Rich Gonzales, CDD Engineering.	***High Pressure Hydrant Inspection Program*** A High Pressure Hydrant Inspection program has been implemented. The SFFD and SFPUC are collectively inspecting and repairing the 1,644 High Pressure Hydrants in the City.

<u>Maintenance Projects: Fiscal Year 2019 – 2020</u>
Over the past year, the City Distribution Division (CDD) of the SFPUC completed numerous important maintenance activities to ensure that the EFWS is in a state of good repair. A summary of maintenance activities can be found in Table 4 of this report (page 7).

<u>Update on Memorandum of Understanding</u>
In 2015, the SFPUC and SFFD signed the *Memorandum of Understanding Regarding the Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression*. The SFPUC and SFFD are actively collaborating to update this Memorandum of Understanding to better detail and memorialize annual emergency response exercises, including simulated disaster and earthquake drills involving the EFWS. The timeline on this update has been delayed due to Coronavirus response; however, SFPUC and SFFD expect this update to be completed in 2020.

Table 4: Summary of Maintenance Activities

Facility Type	Facility	Activity Category	Type of Activity	Typical Frequency	Date Range: Jul 1, 2019 - June 15, 2020 — Work Performed (Labor Hours)	Total Quantity of Maintenance Activities
Hydrants	Low Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect Condition Hydrant and Auxiliary Valve	296	Quantity inspected available upon request
			Condition Assessment*- College Hill Pressure Zone Hydrants and Valves	May 5, 2019 through July 16, 2019	556	932
			Hydrant Corrective Maintenance & Preventative Maintenance Activities	Ongoing	2,413	538
			Replace Caps & Chains and Service Hydrants	SFFD Requests	2,513	Quantity serviced and repaired available upon request
			Hit Hydrants	As Needed	483	57
			Preventative Maintenance	Ongoing by AWSS District	708	Quantity serviced available upon request
			Auxiliary Gate Valve Maintenance	Remove Debris and Uncover Aux. Gate Valves	515.5	98
		New Hydrants Installed	Replace/Install/Relocate Hydrants	As Needed	N/A	233

	High Pressure Hydrants	Maintenance	Hydrant Inspections	Collect Data and Inspect and Document Condition of King Valves	1,793	Quantity inspected available upon request
			Hydrant Maintenance	Upon SFFD Request and Proactive Follow up Work from Inspections	2,966	508
			Rebuild High Pressure Hydrants and Scrap	Corrective - to support CM and Service Hydrant Program	2,015	N/A
		New Hydrants Installed	Install New High Pressure Hydrants	Redevelopment Projects	N/A	3
	Combined Low/High Pressure	Paint Hydrants	Paint Hydrant - Vandalism and Reported by SFFD	Ongoing	4,836	Labor based on Standing Work Orders
System Pipes		Replace and Renew Main Pipes	Main Pipe Leaks	As-needed	332	2
		Replace and Renew Hydrant Leads	Hydrant Leads	As-needed	860	5
Valves		Maintenance	Exercise Critical Valves	Once every 2 years	0*	Exercised 63 Critical Valves FY 18/19; To Exercise all valves FY 20/21
			Valve Vault Maintenance, Pump Flooded Vaults, Electrical and Mechanical Inspections	Corrective Maintenance based on FY 17/18 Survey	273	Location Details Available Upon Request
			System Valve Renewal	As-needed	783	6
			Altitude Valve Inspections	As-needed	15	-

			Inspect, Test, and Repair Valves/Actuators	As-needed	0	-
		Ames Valve Testing	Test Ames Valves	Ongoing	476	Quantity inspected available upon request
Pump Stations	PS1	Maintenance	Pump Testing and Backup Generator	Monthly	934	-
	PS2	Maintenance	Pump Testing and Emergency Backup Generator	BiMonthly	16	-
Tanks	Jones Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing and Backup Generator	Monthly	16	-
	Ashbury Tank	Maintenance	Tank Inspections	Monthly	16	-
			Pump Testing	BiMonthly	4	-
Reservoir	Twin Peaks Reservoir	Maintenance	Inspect & Fill Twin Peaks Reservoir	As-needed	90	-
Cisterns		Maintenance & Inspections	Repair/Replace Cistern Handles, Fill Cisterns	As-needed	357	173
Suction Connections & Manifolds		Maintenance	Connection/Manifold Inspections and SFFD Dive Team Assistance	As-needed	0**	PM program scheduled for FY20/21
Manifold		Maintenance	Fire Boat Testing/Training	As-needed	185	-
Other Support		Maintenance/Operations Support	Instrumentation and Controls Calibration at all AWSS Facilities	Monthly	305	-
			Planning Support and Administration	Field Staff Planning and Supervisorial (Non-Management Labor)	2,057	-
			Landscaping & Pest Management	Quarterly	692.5	-

		Materials Management	As-needed (Includes only Non-Warehouse Staff Labor Charges)	767	-

Notes

* AWSS critical valves were exercised in FY18/19 and are scheduled to be exercised in FY20/21 (two-year cycle)

** Bay suction manifolds preventative maintenance program is scheduled for FY20/21

[Declaring a State of Urgency - Expanding the City's Emergency Firefighting Water System]

Resolution declaring a State of Urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

WHEREAS, The United States Geological Survey (USGS) estimates that the probability an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent; and

WHEREAS, In San Francisco, the most densely populated city in California, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings, and earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo, and San Francisco remains highly vulnerable to fire after an earthquake, as explained in a 2008 article for the *International Association for Fire Safety Science*; and

WHEREAS, The San Francisco Fire Department (SFFD), the San Francisco Public Utilities Commission (SFPUC), and this Board of Supervisors share a common goal of increasing the firefighting capabilities of all areas of San Francisco; and

WHEREAS, The EFWS is a high-pressure and volume fire suppression water system that can be utilized during large fires and is vital for protection against the loss of life, homes, and businesses from fire following a major earthquake and non-earthquake multiple-alarm fires; and

WHEREAS, The EFWS does not cover large parts of nor adequately protect Supervisorial Districts 1, 4, 7, and 11, roughly one-third of the City's developed area, which also have the fewest cisterns, and each fewer than ten miles of EFWS mains and fewer than 50 EFWS fire hydrants; and

WHEREAS, In June 2003, the 2002-2003 Civil Grand Jury recommended that the EFWS be extended "to serve all parts of the City," and 16 years later many neighborhoods still do not have new EFWS pipelines; and

WHEREAS, The SFPUC is developing a preliminary list of potential projects for various parts of the City where there is currently limited access to the EFWS, as well as other projects to reinforce or otherwise improve the existing EFWS; and

WHEREAS, The City does not have an agreed-upon timeline to fund and complete development of EFWS for all areas of the City, including neighborhoods that historically have not been as well protected as other areas of the City; and

WHEREAS, Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before some parts of the City have a high-pressure and volume, multi-sourced, seismically safe emergency firefighting water supply; and

WHEREAS, While the amount of money needed to implement EFWS citywide is estimated to be in the hundreds of millions of dollars, the potential loss of life and potential property damage could be far greater if an extremely large earthquake strikes San Francisco; and

WHEREAS, Based on the City's current pace of issuing ESER Bonds, it could take approximately 35 years or more to build out EFWS pipelines to serve all neighborhoods, unless the timing of the ESER Bond issuances are expedited or other sources of funding are identified; and

WHEREAS, SFPUC and SFFD are in the process of analyzing the best method for bringing a robust and resilient high-pressure and volume firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and are examining several options for the Westside, including potential development of a potable EFWS with over 14 miles of new EFWS pipelines and two new pump stations that could be supplied by four water sources; and

WHEREAS, To best utilize the existing EFWS and serve areas where the EFWS is lacking, it is critical that the SFFD obtain new updated Hose Tenders; and

WHEREAS, SFFD hose tenders are specialized apparatus designed for pumping and transporting large volumes of water from any source, are recognized worldwide for their ability to successfully move large amounts of water to a fire at high-pressures and volumes for firefighting, and are the ideal solution for areas with limited access to the EFWS because these vehicles can be dynamically deployed to any area of the City; and

WHEREAS, The SFFD currently has five Hose Tenders, three from 1973, one from 1987, and one from 1992, all of which are two-wheel drive, and do not have the capacity to draft or pump water; and

WHEREAS, In FY2019-2020 SFFD submitted a request for funding to purchase 20 Portable Water Supply System (PWSS) hose tenders, the Board of Supervisors and Mayor funded four new PWSS hose tenders, and the State of California funded one; and

WHEREAS, On October 8, 2019, Supervisor Gordon Mar requested the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board no later than December 31, 2020 (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term; and

WHEREAS, On October 1st, 2019, the San Francisco Board of Supervisors adopted a Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," on file with the Clerk of the Board of Supervisors in File No. 190786, which is hereby declared to be a part of this Resolution as if set forth fully herein; now, therefore, be it

RESOLVED, That the Board of Supervisors hereby declares a State of Urgency to rapidly expand the City's EFWS to protect all neighborhoods in the event of a major earthquake and fire, given that the vulnerability of the City poses a serious and urgent threat to the well-being of San Francisco and the safety of its inhabitants and environment; and be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC, SFFD and the Office of Resilience and Capital Planning to develop a comprehensive EFWS action plan, including funding sources, to install a high-pressure and volume, multi-sourced, seismically safe emergency water system to fight fires in the event of a major earthquake in all the parts of the City where it is lacking by June 30, 2034, to be submitted to the Board of Supervisors by December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC and SFFD to complete a study for adding an EFWS saltwater pump station on the Westside of San Francisco to be presented to the Board no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the SFPUC to continue its efforts to complete more detailed analysis of emergency firefighting water needs by neighborhood and prepare a completed analysis by June 30, 2021; and, be it

FURTHER RESOLVED, That by June 30, 2022, the City should analyze whether to propose a separate bond for the development and implementation of EFWS projects for areas of the City with limited EFWS access as part of the City's regular capital planning process; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to prioritize funding for the purchase of new PWSS hose tenders, apparatus, and equipment to replace and expand SFFD's currently inadequate inventory within the next three Fiscal Years; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Department of Emergency Management, SFPUC, SFFD, and the Office of Resilience and Capital Planning to provide a consolidated annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire and planned funding from the ten-year Capital Plan for EFWS by June 30 of each year, with the first report due June 30, 2020.

City and County of San Francisco
Tails
Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 191029 **Date Passed:** November 19, 2019

Resolution declaring a state of urgency to rapidly expand the City's Emergency Firefighting Water System (EFWS) to protect all neighborhoods in the event of a major earthquake and fire, and calling for a comprehensive EFWS action plan to expand the City's EFWS to cover all unprotected neighborhoods by 2034; to expand the Fire Department's firefighting apparatus such as portable hose tenders to provide interim protection to neighborhoods not currently covered by the EFWS; and to require an annual report to the Board of Supervisors on the state of the City's EFWS preparedness for a major earthquake and fire.

November 08, 2019 Public Safety and Neighborhood Services Committee - RECOMMENDED

November 19, 2019 Board of Supervisors - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

November 19, 2019 Board of Supervisors - ADOPTED AS AMENDED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 191029

I hereby certify that the foregoing Resolution was ADOPTED AS AMENDED on 11/19/2019 by the Board of Supervisors of the City and County of San Francisco.

f Angela Calvillo
Clerk of the Board

Unsigned

London N. Breed
Mayor

11/27/19

Date Approved

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Peggy Nevin	11/27/19
for Angela Calvillo Clerk of the Board	Date

File No.
191029

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

October 15, 2019

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Department 206
San Francisco, CA 94102

RE: Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Dear Judge Wong:

The Board of Supervisors' Government Audit and Oversight Committee conducted a public hearing on September 19, 2019, to review the findings and recommendations of the 2018-2019 Civil Grand Jury report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Prior to the Committee meeting, the following City Departments submitted required responses to the Civil Grand Jury:

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;
- Fire Department:
  Received September 16, 2019;
- City Administrator:
  Received September 16, 2019; and
- Department of the Environment
  Received September 16, 2019.

Continues on next page

During the September 19, 2019 meeting, the Government Audit and Oversight Committee prepared a resolution responding to the requested findings and recommendations identified in the report. The response was prepared by Resolution No. 422-19, enacted on October 11, 2019.

By this message, the Office of the Clerk of the Board of Supervisors is transmitting Resolution No. 422-19 to your attention.

If you have any questions, please contact John Carroll, Government Audit and Oversight Committee Clerk at (415) 554-4445, or via email to john.carroll@sfgov.org.

Sincerely,

Alisa Somera

f Angela Calvillo
Clerk of the Board

c:
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Mark de la Rosa, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Ettore Leale, 2019-2020 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

City and County of San Francisco

Certified Copy

Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

190786 **[Board Response - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]**

Sponsor: Mar

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget. (Clerk of the Board)

10/1/2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

10/11/2019 Mayor - RETURNED UNSIGNED

STATE OF CALIFORNIA
CITY AND COUNTY OF SAN FRANCISCO

CLERK'S CERTIFICATE

I do hereby certify that the foregoing Resolution is a full, true, and correct copy of the original thereof on file in this office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the offical seal of the City and County of San Francisco.

October 15, 2019
Date

Angela Calvillo
Clerk of the Board

AMENDED IN COMMITTEE
9/19/19

FILE NO. 190786 RESOLUTION NO. 422-19

[Board Response - Civil Grand Jury Report - Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System]

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

WHEREAS, Under California Penal Code, Section 933 et seq., the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on the findings and recommendations contained in Civil Grand Jury Reports; and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), if a finding or recommendation of the Civil Grand Jury addresses budgetary or personnel matters of a county agency or a department headed by an elected officer, the agency or department head and the Board of Supervisors shall respond if requested by the Civil Grand Jury, but the response of the Board of Supervisors shall address only budgetary or personnel matters over which it has some decision making authority; and

WHEREAS, Under San Francisco Administrative Code, Section 2.10(a), the Board of Supervisors must conduct a public hearing by a committee to consider a final report of the findings and recommendations submitted, and notify the current foreperson and immediate past foreperson of the civil grand jury when such hearing is scheduled; and

WHEREAS, In accordance with San Francisco Administrative Code, Section 2.10(b), the Controller must report to the Board of Supervisors on the implementation of

recommendations that pertain to fiscal matters that were considered at a public hearing held by a Board of Supervisors Committee; and

WHEREAS, The 2018-2019 Civil Grand Jury Report, entitled "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" ("Report") is on file with the Clerk of the Board of Supervisors in File No. 190785, which is hereby declared to be a part of this Resolution as if set forth fully herein; and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors and the Budget and Legislative Analyst respond to Finding Nos. F6, and F11, as well as Recommendation No. R3, contained in the subject Report; and

WHEREAS, Finding No. F6 states: "Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply;" and

WHEREAS, Finding No. F11 states: "The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods;" and

WHEREAS, Recommendation No. R3 states: "The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020;" and

WHEREAS, The Civil Grand Jury has requested that the Board of Supervisors respond to Finding Nos. F4, and F5, as well as Recommendation Nos. R1, R2, R4, R6, R7, and R8, contained in the subject Report; and

WHEREAS, Finding No. F4 states: "The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake;" and

WHEREAS, Finding No. F5 states: "A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City;" and

WHEREAS, Recommendation No. R1 states: "By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake;" and

WHEREAS, Recommendation No. R2 states: "The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034;" and

WHEREAS, Recommendation No. R4 states: "As an interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory;" and

WHEREAS, Recommendation No. R6 states: "The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations

from this study should be presented to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R7 states: "The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021;" and

WHEREAS, Recommendation No. R8 states: "By no later than June 30, 2022, the Mayor and Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034;" and

WHEREAS, In accordance with California Penal Code, Section 933.05(c), the Board of Supervisors must respond, within 90 days of receipt, to the Presiding Judge of the Superior Court on Finding Nos. F4, F5, F6, and F11, as well as Recommendation Nos. R1, R2, R3, R4, R6, R7, and R8 contained in the subject Report; now, therefore, be it

RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F4; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F5; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F6; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports to the Presiding Judge of the Superior Court that they agree with Finding No. F11; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R1 has not been implemented but will be implemented no later than December 31, 2021,

and urges the Mayor, the SFPUC, the SFFD, and Office of Resilience and Capital Planning to jointly present a detailed plan to the Board of Supervisors by no later than December 31, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R2 has not been implemented but will be implemented by December 31, 2021, and urges the Departments to include in its detailed plan a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R3 has not been implemented but will be implemented in the future, and Supervisor Gordon Mar will issue a request for a Budget and Legislative Analyst report no later than December 31, 2019, and will direct the Budget and Legislative Analyst to issue the completed report no later than December 31, 2020; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R4 will not be implemented because while funding for five hose tenders was allocated for FY2019-2020 though both local and state-level actions, implementation of the recommendation in its entirety will depend on the appropriation actions of a future Mayor and Board of Supervisors; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R6 has not been implemented but will be implemented in the future, and urges the completion of a study for adding a salt-water pump stations to be presented to the Board of Supervisors by no later than June 30, 2021, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R7 has not been implemented but will be implemented in the future, and urges that a

completed analysis be presented to the Board of Supervisors by no later than June 30, 2021; and, be it

FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R8 has not been implemented but will be implemented in the future, and will analyze by June 30, 2022, in coordination with the Mayor, whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034; and, be it

FURTHER RESOLVED, That the Board of Supervisors urges the Mayor to cause the implementation of the accepted findings and recommendations through his/her department heads and through the development of the annual budget.

City and County of San Francisco
Tails
Resolution

City Hall
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4689

File Number: 190786 **Date Passed:** October 01, 2019

Resolution responding to the Presiding Judge of the Superior Court on the findings and recommendations contained in the 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System;" and urging the Mayor to cause the implementation of accepted findings and recommendations through his/her department heads and through the development of the annual budget.

September 19, 2019 Government Audit and Oversight Committee - AMENDED, AN AMENDMENT OF THE WHOLE BEARING SAME TITLE

September 19, 2019 Government Audit and Oversight Committee - RECOMMENDED AS AMENDED

October 01, 2019 Board of Supervisors - ADOPTED

Ayes: 11 - Brown, Fewer, Haney, Mandelman, Mar, Peskin, Ronen, Safai, Stefani, Walton and Yee

File No. 190786

I hereby certify that the foregoing Resolution was ADOPTED on 10/1/2019 by the Board of Supervisors of the City and County of San Francisco.

for Angela Calvillo
Clerk of the Board

Unsigned

London N. Breed
Mayor

10/11/2019

Date Approved

File No. 190786

I hereby certify that the foregoing resolution, not being signed by the Mayor within the time limit as set forth in Section 3.103 of the Charter, or time waived pursuant to Board Rule 2.14.2, became effective without her approval in accordance with the provision of said Section 3.103 of the Charter or Board Rule 2.14.2.

Alisa Somera

for ~~Angela Calvillo~~
Clerk of the Board

10/11/2019
Date

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **19-0178**

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, end push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthqueke (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the egency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco thet is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locetions ere entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenence/testing records, reguler maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.						

2018-2019 CIVIL GRAND JURY FINDINGS, RECOMMENDATIONS, AND RESPONSES TO FINDINGS AND RECOMMENDATIONS

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

2018-2019 CIVIL GRAND JURY FINDINGS, RECOMMENDATIONS, AND RESPONSES TO FINDINGS AND RECOMMENDATIONS

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 (for F4)	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnituda (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capitel Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be Implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir thet could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regionel Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implemant a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be Implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be Implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be Implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be Implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

Civil Grand Jury 2018-19 Report:

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

John Scarpulla
SFPUC

San Francisco Water Power Sewer

ONESF
Building Our Future

What is the EFWS?

- Emergency Firefighting Water System (EFWS): A high-pressure fire-suppression water system built after 1906 earthquake

- Ownership transferred to SFPUC in 2010

- SFFD is the end user: System improvements and expansion approved by SFFD, SFPUC, and Public Works

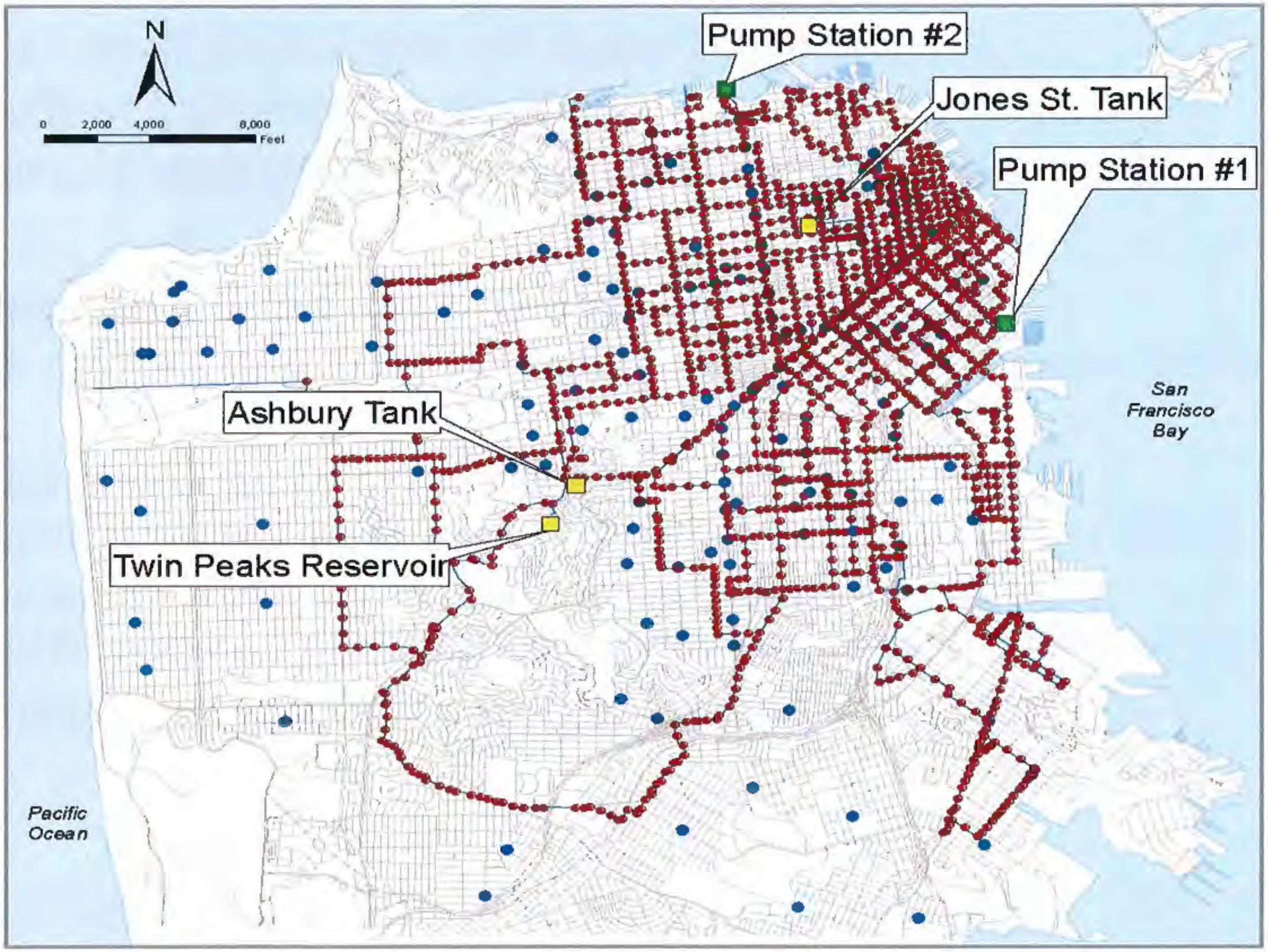
- Hydraulic Modeling utilized to guide decision making.

Water Power Sewer

ONESF
Building Our Future

Original EFWS Map

33 Seismically Reliable Valves Throughout System



Water Power Sewer

ONESF Building Our Future

Partnership

- Evaluation of EFWS when transferred to SFPUC:
  - Using modern seismic resilience capability analysis looking for vulnerabilities, leading to immediate and future projects
  - 47% system reliability for median flow of water needed by SFFD to fight fires after 7.8 earthquake
- Since 2010 - SFPUC, SFFD, and Public Works have been implementing projects to improve the EFWS.
- Projects completed utilizing Earthquake Safety and Emergency Response Bonds:
  - 2010 Bond: $102 million for EFWS capital projects
  - 2014 Bond: $54 million for EFWS capital projects

Water Power Sewer
ONESF
Building Our Future

Key ESER Projects Completed

- EFWS Reliability upgrades at three primary source supplies:
  - Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank
- Replaced engines and installed remote control capabilities for Seawater pump station #1
- Installation of 30 new cisterns:
  - 15 in the Sunset and Richmond districts
- Electronic Control Improvements
- 6 pipeline and tunnel projects

Key ESER Projects Underway

- Seawater pump station #2
- 19th Ave. Pipeline:
  - Bidding Feb 2020
- Ashbury Bypass Pipeline
- Clarendon Supply Pipeline
- Irving St. Pipeline
- Terry Francois Blvd. Pipeline:
  - Phase 1: completed
  - Phase 2: Bidding 2019

San Francisco Water Power Sewer

ONESF Building Our Future

Development Projects

- Large Development Projects install EFWS pipes within their development boundaries.
- SFFD & SFPUC negotiate with Developers for projects outside of the development boundaries.

- **Mission Rock**
- **Mission Bay**
- **Pier 70**
- **Potrero Powerplant**
- **Potrero Hope SF**
- **Sunnydale Hope SF**
- **Park Merced**
- **Candlestick**
- **Hunters Point/Shipyard**
- **Executive Park**
- **Visitation Valley**
- **India Basin**

San Francisco Water Power Sewer

ONESF Building Our Future

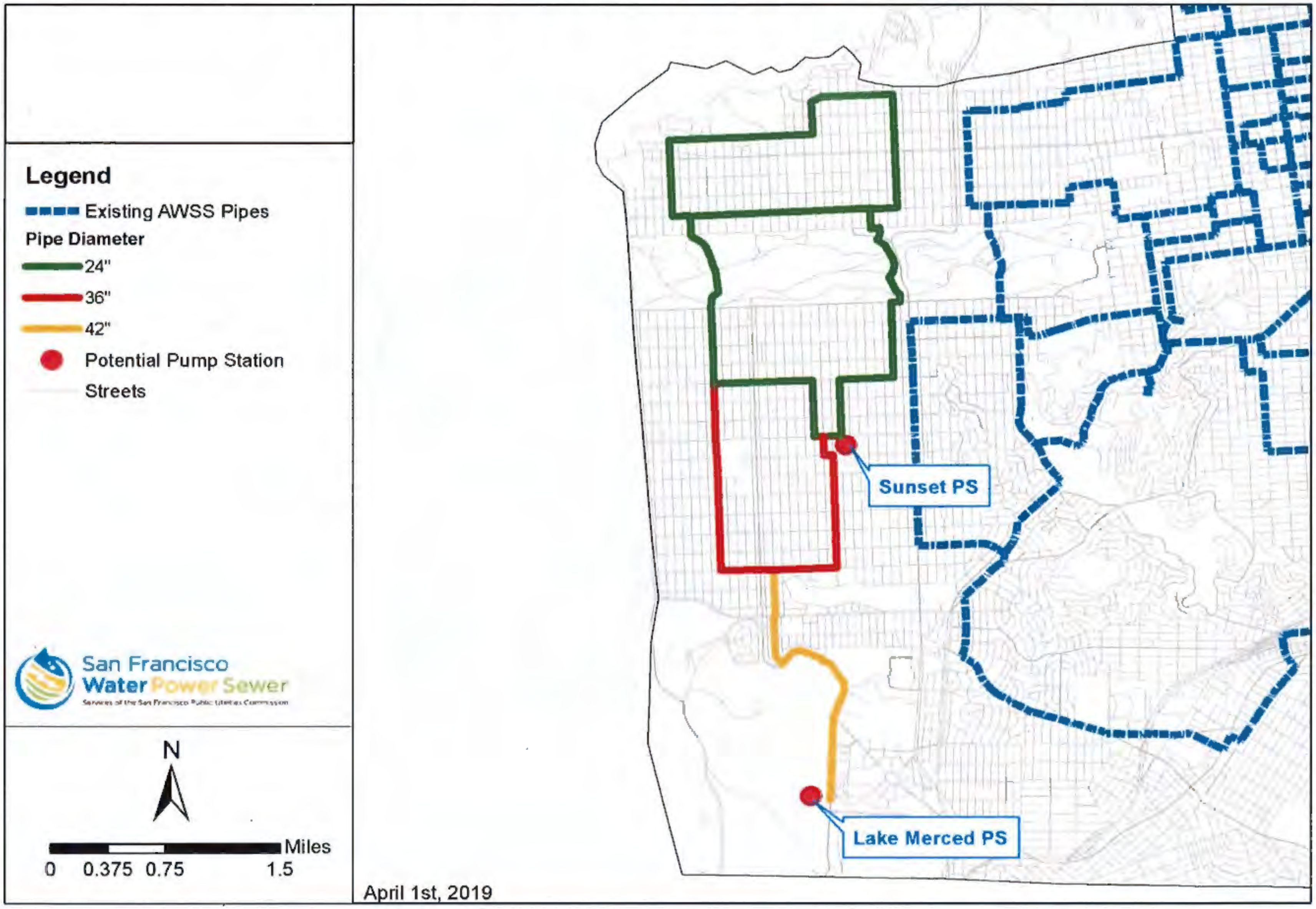
Preliminary List of Potential Projects

- Developed a preliminary list of potential projects that SFPUC and SFFD continue to develop and analyze

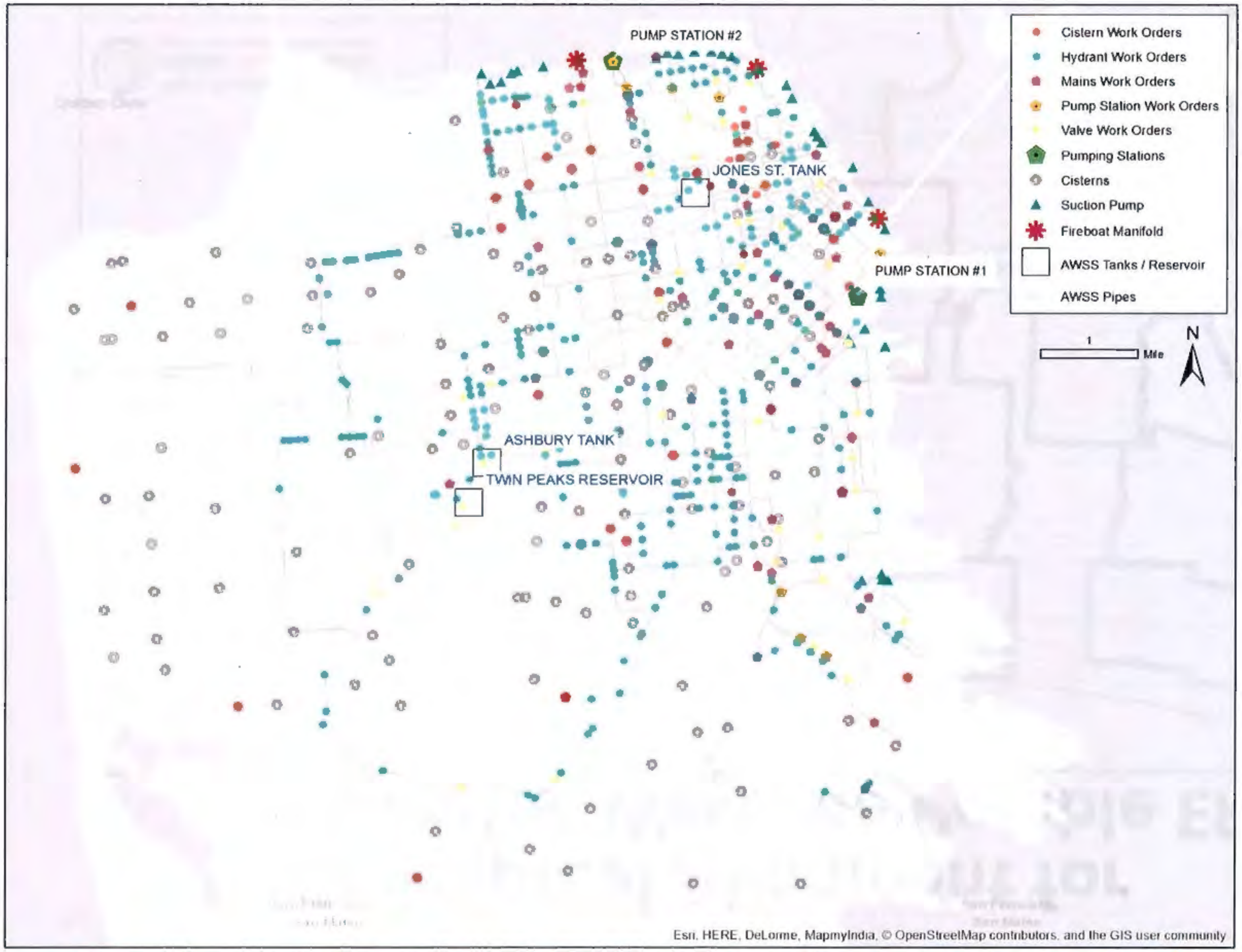
- Preliminary projects range in scope:
  - Pipeline projects
  - New water sources
  - Infirm area projects

- Citywide with a focus in areas that have limited access to the EFWS

Conceptual Alignment for Potential Westside Potable EFWS



Maintenance Activities



San Francisco Water Power Sewer

ONESF
Building Our Future

Moving Forward

- Continue to implement EFWS projects using remaining 2014 ESER Bonds: ***estimated completion end of 2021***
- Continue to perform routine and high-quality maintenance on the EFWS to ensure it is in good working order: ***ongoing***
- 5 Hose Tenders in FY19-20 Budget (4 in City Budget, 1 from State)
- Continue to conduct regular emergency response trainings with all applicable City agencies, while also working collaboratively to enhance the scope and frequency of trainings: ***ongoing***
- Memorialize a detailed roadmap for annual emergency response exercises in SFFD-SFPUC Memorandum of Understanding: ***6/30/2020***

San Francisco Water Power Sewer

ONESF Building Our Future

Moving Forward Cont'd.

- SFPUC and SFFD complete seawater pump station study: ***6/30/2021***

- SFPUC to continue efforts to complete more detailed analysis of emergency firefighting water needs within neighborhoods: ***6/30/2021***

- Develop a robust and thorough plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 7.8 earthquake: ***12/31/2021***

- Quarterly presentations to SFPUC Citizen Advisory Committee and increased community meetings: ***ongoing***

ONESF
Building Our Future

EFWS in the Capital Plan

- Recent Funding
  - ESER 2010: $102.4 million
  - ESER 2014: $54.1 million
- FY2020-29 Capital Plan
  - ESER 2020: $153.5 million
  - SFPUC Funds
  - Future ESER Funds

San Francisco Water Power Sewer

ONESF Building Our Future

Thank you

ONESF
Building Our Future

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

DATE: September 16, 2019

TO: Members of the Board of Supervisors

FROM: AC Angela Calvillo, Clerk of the Board

SUBJECT: 2018-2019 Civil Grand Jury report, entitled
"Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

We are in receipt of the following required responses to the San Francisco Civil Grand Jury report released July 17, 2019, entitled: "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System." Pursuant to California Penal Code, Sections 933 and 933.05, named City Departments shall respond to the report within 60 days of receipt, or no later than September 15, 2019.

For each finding the Department response shall:

1) agree with the finding; or
2) disagree with it, wholly or partially, and explain why.

As to each recommendation the Department shall report that:

1) the recommendation has been implemented, with a summary explanation; or
2) the recommendation has not been implemented but will be within a set timeframe as provided; or
3) the recommendation requires further analysis. The officer or agency head must define what additional study is needed. The Grand Jury expects a progress report within six months; or
4) the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

The Civil Grand Jury Report identified the following City Departments to submit responses (attached):

- Office of the Mayor:
  Received September 16, 2019;
- General Manager of the San Francisco Public Utilities Commission:
  Received September 16, 2019;
- Public Utilities Commission:
  Received September 11, 2019
- Fire Commission:
  Received September 12, 2019;

Continues on next page

- Fire Department:
  Received September 16, 2019; and
- City Administrator:
  Received September 16, 2019.
- Department of the Environment
  Received September 16, 2019.

These departmental responses are being provided for your information, as received, and may not conform to the parameters stated in California Penal Code, Section 933.05 et seq. The Government Audit and Oversight Committee will consider the subject report, along with the responses, at a hearing on September 19, 2019.

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

OFFICE OF THE MAYOR
SAN FRANCISCO

LONDON N. BREED
MAYOR

September 16, 2019

The Honorable Garrett L. Wong
Presiding Judge, Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong,

In accordance with Penal Code 933 and 933.05, the following is in response to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System.* We would like to thank the members of the 2018-2019 Civil Grand Jury for their interest in disaster preparedness and in improving the resiliency of our critical public safety infrastructure to provide robust emergency firefighting to all communities in San Francisco.

San Francisco continues to improve our City's resiliency each day through our ongoing investments in public infrastructure and equipment. Our Capital Planning Program coordinates much of these investments by conducting strategic long-term planning across major programs and projects, including the Emergency Firefighting Water System and Earthquake Safety and Emergency Response (ESER). The ESER bonds approved by voters in 2010 and 2014 have funded improvements to cisterns, pipelines, and critical public facilities that improve the City's ability to respond in emergencies and to fight fires. In addition, through the City's annual budgeting process, we will continue weighing resources to improve public safety and the operational readiness and emergency response capabilities of our departments. For example, our most recently adopted FY 2019-20 budget includes funding for five new hose tenders to replace and enhance the Fire Department's aging equipment.

In March 2020, the voters of San Francisco will once again vote on a new $628.5 million ESER bond measure. Included in the proposal is an investment of an additional $153.5 million for the Emergency Firefighting Water System.

We appreciate the opportunity to comment on the Civil Grand Jury report findings and recommendations. Moving forward, and as appropriate, the City plans to analyze many of the recommendations as part of our next 10-Year Capital Plan.

A detailed response from the Mayor's Office, City Administrator's Office, Fire Department, Public Utilities Commission, and the Department of the Environment is attached.

Each signatory prepared its own responses and is able to respond to questions related to its respective part of the report.

Sincerely,

London N. Breed
Mayor

Harlan L. Kelly Jr.
General Manager, Public Utilities Commission

Jeanine Nicholson
Chief, Fire Department

Naomi Kelly
City Administrator

Deborah Raphael
Director, Department of the Environment

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.	R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]	Will be implemented	The analysis will be performed as part of the City's 10-Year Capital Plan development process. The next full update to the Capital Plan will be submitted to the Mayor and Board not later than March 1, 2021, for approval no later than May 1, 2021.

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]	Will not be implemented because it is not warranted or reasonable	Not applicable to the San Francisco Department of the Environment

File No. 190785 **Committee Item No.** 2
Board Item No. ____

COMMITTEE/BOARD OF SUPERVISORS

AGENDA PACKET CONTENTS LIST

Committee: Government Audit and Oversight **Date:** Sept. 19, 2019
Board of Supervisors Meeting: **Date:** ____

Cmte Board

- ☐ ☐ **Motion**
- ☐ ☐ **Resolution**
- ☐ ☐ **Ordinance**
- ☐ ☐ **Legislative Digest**
- ☐ ☐ **Budget and Legislative Analyst Report**
- ☐ ☐ **Youth Commission Report**
- ☒ ☐ **Introduction Form**
- ☐ ☐ **Department/Agency Cover Letter and/or Report**
- ☐ ☐ **MOU**
- ☐ ☐ **Grant Information Form**
- ☐ ☐ **Grant Budget**
- ☐ ☐ **Subcontract Budget**
- ☐ ☐ **Contract/Agreement**
- ☐ ☐ **Form 126 – Ethics Commission**
- ☐ ☐ **Award Letter**
- ☐ ☐ **Application**
- ☐ ☐ **Public Correspondence**

OTHER

- ☒ ☐ SFPUC Response – September 11, 2019
- ☒ ☐ Fire Commission Response – September 12, 2019
- ☒ ☐ Civil Grand Jury Report – July 17, 2019
- ☒ ☐ COB Letter – July 24, 2019
- ☒ ☐ Response Matrices
- ☒ ☐ Transmittal Letters

Prepared by: John Carroll **Date:** Sept. 12, 2019
Prepared by: John Carroll **Date:** ____

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	San Francisco Public Utilities Commission Response (by the Commission President) to the 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:14:02 AM
Attachments:	President Caen Letter to CGJ.pdf

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Wednesday, September 11, 2019 11:11 AM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

---

From: Hood, Donna
Sent: Wednesday, September 11, 2019 11:10:54 AM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Kelly Jr, Harlan; Breed, London (MYR)
Subject: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

⚠WARNING: This email was generated from an external source. You should only open files from a trustworthy source.

Good Morning,

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*.

Thank you,

Donna Hood
Commission Secretary
San Francisco Water, Power and Sewer/Services of the San Francisco Public Utilities Commission
525 Golden Gate Ave., 13th Floor
San Francisco, CA 94102
415-554-0761 (direct)
http://sfwater.org/

Conserve a drop today for a drink tomorrow! Learn how at www.sfwater.org/conservation

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **19-0178**

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.					

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	Fire Commission Response to 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:03:24 AM
Attachments:	Copy of Fire Commission_Nakajo_AWSS Matrix of Findings and Recommendations Response 190904.xlsx

---

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Thursday, September 12, 2019 1:24 PM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Civil Grand Jury Report

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 1:24:22 PM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Rasha Harvey; Steve Nakajo (sknakajo@yahoo.com); Nicholson, Jeanine (FIR)
Subject: RE: Civil Grand Jury Report

⚠ **WARNING: This email was generated from an external source. You should only open files from a trustworthy source.**

Here's the correct document.

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 11:45 AM
To: CGrandJury@sftc.org
Cc: Rasha Harvey <r.harvey@sfcgj.org>; Steve Nakajo (sknakajo@yahoo.com) <sknakajo@yahoo.com>; Nicholson, Jeanine (FIR) <jeanine.nicholson@sfgov.org>
Subject: Civil Grand Jury Report

Dear Honorable Garrett L. Wong,

Please see attachments.   I will also send by U.S. Mail.

Sincerely,

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

CITY AND COUNTY OF SAN FRANCISCO

2018-2019 CIVIL GRAND JURY

MEMORANDUM

TO: Mayor and Members of the Board of Supervisors

CC: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Anatolia Lubos, Grand Jury Administrative Analyst

DATE: July 18, 2019

SUBJECT: Civil Grand Jury Report, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

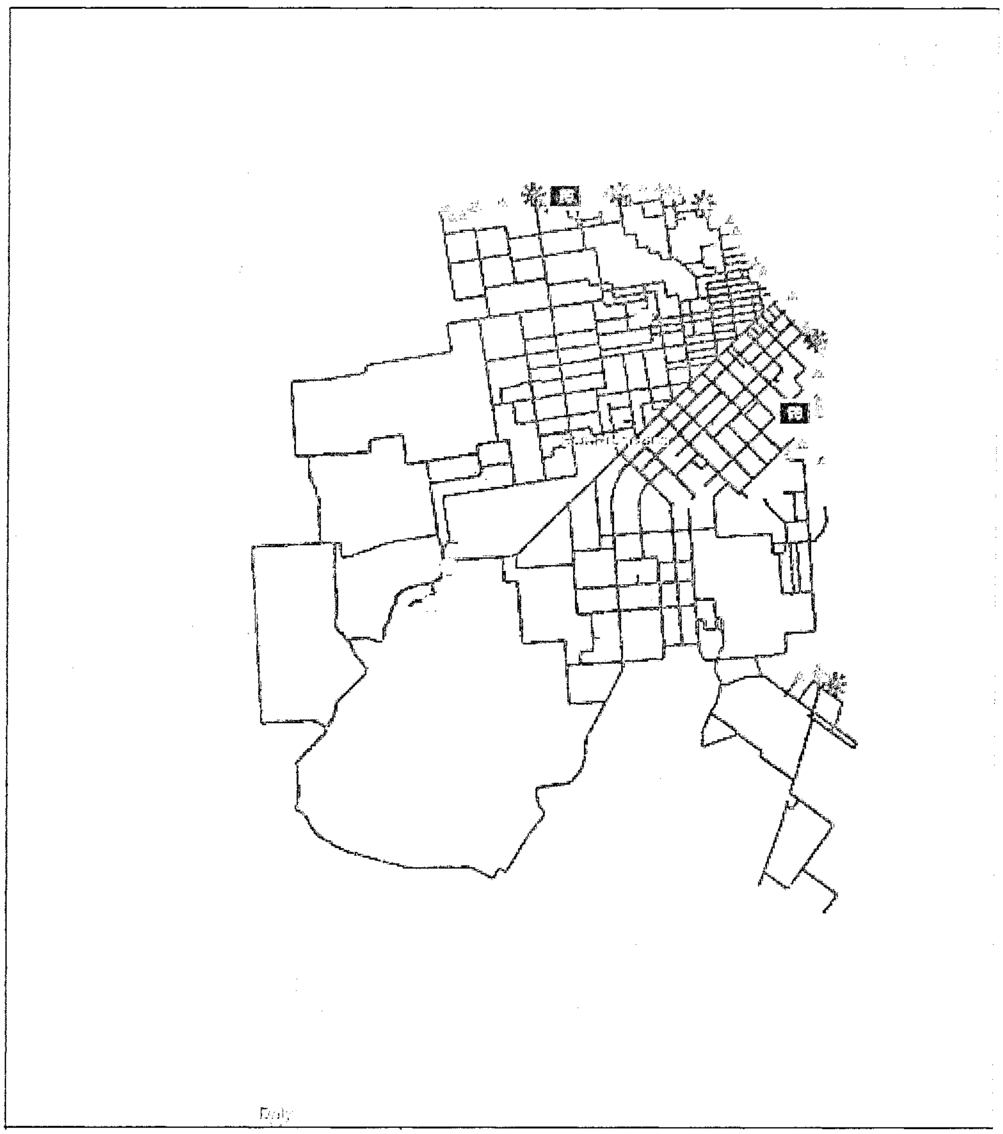
The previous version of the aforementioned Civil Grand Jury report as received and distributed on Monday, July 15, 2019 was incomplete and omitted Appendices F to R (inclusive).

Enclosed is the complete report.

400 MCALLISTER STREET, ROOM 008, SAN FRANCISCO, CA 94102
PHONE: 415-551-3635

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR HIGH-PRESSURE EMERGENCY FIREFIGHTING WATER SYSTEM



CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

THE CIVIL GRAND JURY AND ITS OPERATIONS

California state law requires that all 58 counties impanel a Grand Jury to serve during each fiscal year. *California Penal Code Section 905; California Constitution, Article I, Section 23*

The Civil Grand Jury investigates and reports on one or more aspects of the County's departments, operations, or functions. *California Penal Code Sections 925, 933(a)*

Reports of the Civil Grand Jury do not identify individuals interviewed by name. *California Penal Code Section 929*

The Civil Grand Jury issues reports with findings and recommendations resulting from its investigations to the Presiding Judge of the Superior Court. *California Penal Code Section 933(a)*

Each published report includes a list of those elected officials or departments that are required to respond to the Presiding Judge of the Superior Court within 60 or 90 days as specified. *California Penal Code Section 933*

California Penal Code Section 933.05 is very specific with respect to the content of the required responses. Under Section 933.05(a), for each finding, the response must:

1) Agree with the finding, or
2) Disagree with it, wholly or partially, and explain why.

Similarly, under Penal Code Section 933.05(b), for each recommendation, the responding party must report that:

1) The recommendation has been implemented, with a summary of the implemented action; or
2) The recommendation has not been implemented but will be within a set timeframe; or
3) The recommendation requires further analysis, with an explanation of what additional study is needed, and the timeframe for conducting that additional study and the preparation of suitable material for discussion. This timeframe may not exceed six months from the date of publication of the Civil Grand Jury's report; or
4) The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Any San Francisco resident who is a US citizen and is interested in volunteering to serve on the Civil Grand Jury for the City and County of San Francisco is urged to apply. Additional information about the San Francisco Civil Grand Jury, including past reports, can be found online at http://civilgrandjury.sfgov.org/index.html .

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

MEMBERSHIP ROSTER

RASHA HARVEY (Foreperson)

JANET ANDREWS HOWES (Parliamentarian)

LINDA BADGER

ANDREW BENJAMIN

GORDON CRESPO

KRISTINE EQUIHUA (Technology Secretary)

STEPHEN GARBER

JONATHAN HILL

LEONARD KULLY (Correspondence Secretary)

WILLIAM LEE (Foreperson Pro Tem)

FRANK NETTLETON

NONA RUSSELL

RANDALL SMITH (Recording Secretary)

KAAREN STRAUCH BROWN

RUSH STURGES

MARTHA SUTHERLIN

JASON TAM

MICHAEL WIXTED

EXECUTIVE SUMMARY

San Francisco is one of the most vulnerable cities in the world, and certainly in the United States, to the risk of fire following an earthquake. In 1906, the City suffered tremendous destruction and devastation from the fires that followed a major earthquake. Over 3,000 people died and approximately 28,000 buildings were destroyed. In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage. We know the question is when, not if, another major earthquake will strike San Francisco and ignite numerous fires.

The Civil Grand Jury believes it is essential that we take prompt and aggressive action to expand and enhance our defenses against the inevitable fires following an earthquake before it is too late. All parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – deserve to be well protected against this catastrophic risk.

Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system (MWSS) -- that provides excellent firefighting protection to parts of the City. However, large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS and are not nearly as well protected.

Plans to develop a seismically safe high-pressure AWSS for the western portions of our City are now moving forward. But even though City leaders have known about this issue for decades, the City still does not have concrete plans or a timeline to provide a more robust emergency firefighting water supply for all parts of the City that need one.

In 2014, the U.S. Geological Survey (USGS) estimated there is a 72 percent chance of one or more magnitude 6.7 or greater earthquakes striking the Bay Area between 2014 and 2043. Earlier this year Mayor London Breed announced that planning for such a disaster is a priority. But at our current pace and funding levels, expansion of a high-pressure AWSS to currently unserved parts of the City will not be completed for another thirty-five (35) years or more–well after the USGS predicts we will be struck by one or more major earthquakes.

The Civil Grand Jury makes the following recommendations, among others which are more fully discussed herein:

- The City should be prepared to fight fires in all parts of the City in the event of a repeat of a 1906 size earthquake;
- The City should aggressively develop a high-pressure, multi-sourced, seismically safe emergency water supply for those parts of the City that don't currently have one, with a target completion date of no later than 2034;
- As an interim measure, the City should immediately replace and expand its inventory of Portable Water Supply System (PWSS) hose tenders, which are comparatively cheap, can be acquired much more quickly than the high-pressure AWSS, and were essential in fighting the 1989 Loma Prieta fire, but are now past their useful life;
- The new PWSS hose tenders should be strategically placed in those areas of the City that do not have a high-pressure, multi-sourced, seismically safe emergency water supply.

TABLE OF CONTENTS

List of Figures	Page No.

List of Tables	Page No.

BACKGROUND AND PROBLEM STATEMENT

No one knows when the next large earthquake is coming. But it is coming.

A. Fire Following Earthquake Is a Major Risk to The City

"San Francisco will sustain major damage from fires following future earthquakes, in addition to the damage caused by shaking."[1] As explained in a 2010 report prepared for the City,

> In San Francisco, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo.[2]

A main reason the 1906 fire was so devastating is that the earthquake destroyed much of the water system.[3]

Fires following earthquakes remain a major threat today. In 1994, approximately 110 fires were ignited after the Northridge earthquake in Los Angeles County, even though it was "only" a 6.7-magnitude earthquake.[4] In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage.[5] In Kobe "broken water

---

[1] Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010) ("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[2] *Id.*; footnote omitted.

[3] See Scawthorn, C., O'Rourke, T. D. & Blackburn, F., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*, Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; see also Scawthorn, C., Water Supply In Regard to Fire Following Earthquake, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 5.

[4] See discussion in Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 7; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 12-17.

[5] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 17-19; ATC, 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

mains left the fire department helpless, and fires destroyed more than 7,000 buildings."[6] A magnitude 7.9 earthquake would be an estimated 10 times larger than a magnitude 6.9 earthquake, and would release approximately 31 times more energy.[7]

San Francisco is by far the most densely populated large city in California and is the second most densely populated large city in the country.[8] With mostly wood construction in many areas, this dense City remains at significant risk.[9]

B. AWSS Background and Current Status

After the 1906 earthquake and its devastating fires, the City built an independent emergency water supply for firefighting, known as the AWSS.[10]

The AWSS is a separate, non-potable emergency firefighting water supply system that at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations.[11] Applying a "belt

---

[6] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[7] See the United States Geological Survey's "How Much Bigger ....?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can compare the relative size and strength of different magnitude earthquakes.

[8] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 6.

[9] Ibid.

[10] See generally SFPUC, Frequently Asked Questions–Fire Suppression Water Systems, dated November 2017 "SFPUC 2017 FAQ", https://sfwater.org/modules/showdocument.aspx?documentid=11507 attached as Appendix N; see also Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf

[11] AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report), February2014 ("CS-199"), at p. 7, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; SFPUC Fact Sheet, dated Summer 2012, located at https://www.sfwater.org/modules/showdocument.aspx?documentid=2501 and printed March 6, 2019. The online Fact Sheet is outdated, as the City has added approximately 30 more cisterns through the 2010 and 2014 ESER bonds. The SFFD also has three large capacity fireboats berthed at Pier 22 ½ and an additional, smaller fireboat berthed at the San Francisco Marina Yacht Harbor.

People sometimes confuse Emergency Firefighting Water System (EFWS) and AWSS, or use them interchangeably. EFWS is the broader concept, including all emergency sources of water and the means for delivering them. AWSS is sometimes described as including cisterns, and other times not. Compare CS-199, at p. 7, ("AWSS is a water supply system consisting of pipelines, cisterns, reservoir, storage tanks, and salt-water pump stations.") https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 with AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report, January 5, 2018 ("2018 Westside Options Analysis"), at pp. 10-13, 20 (differentiating between EFWS and AWSS, and discussing cisterns as a supplement to but not part of AWSS), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

and suspenders" approach, if the City's MWSS mains break leaving low-pressure hydrants useless, firefighters will have access to other sources of water, including the Twin Peaks Reservoir and the Bay. Unlike the MWSS, AWSS pipelines were designed to withstand movement from an earthquake.[12]

The AWSS is "remarkably well designed to furnish large amounts of water for firefighting purposes under normal conditions and contains many special features to increase reliability in the event of an earthquake."[13] The AWSS is "designed to provide water at higher pressures than the potable water system, allowing firefighters to use water from the AWSS hydrants without requiring a fire engine."[14]

Another of the key features of the AWSS is its redundancy. The HP AWSS was designed with both a redundant water supply and a gridded main system.[15] This feature provides a more reliable emergency water supply system, allowing potential pipe breaks to be bypassed.[16] As succinctly stated by an outside expert, "the AWSS achieves high reliability by having multiple sources, a highly redundant network and special piping and valves."[17]

The AWSS was originally built over 100 years ago, at a time when the northeast portion of the City contained both the central business district and the majority of the City's population.[18] As a result, the multi-sourced, HP AWSS pipeline network primarily covers just the northeastern part of the City.[19]

The City has been considering expanding the HP AWSS for decades. For example the Analysis by the Ballot Simplification Committee of 1986's Proposition A, Fire Protection Bonds, specifically noted that parts of the City were not served by the HP AWSS:

This report will use EFWS as the broader concept, and will generally use AWSS to refer to the HP AWSS (the 135 miles of pipelines and associated facilities but not including cisterns), although we will not change quotes. This distinction is important, as there are cisterns in the southern and western portions of the City, but not the HP AWSS.

[12] CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[13] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf,, at p. 80; see also Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp.12-15.

[14] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[15] *Id.*, at p. 37.

[16] Ibid.

[17] C. Scawthorn, January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis" "Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 .

[18] See SFPUC 2017 FAQ, Question 2, at https://sfwater.org/modules/showdocument.aspx?documentid=11507 , a copy of which is attached as Appendix N.

[19] *Id.*

THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.[20]

In June 2003, the 2002-2003 Civil Grand Jury recommended that the HP AWSS be extended "to serve all parts of the City."[21] Yet three decades after the 1986 bond and 16 years after the prior Civil Grand Jury report, many neighborhoods still do not have HP AWSS pipelines.[22] Plans are moving forward to fund a new HP AWSS using potable water on the west side through an upcoming Earthquake Safety and Emergency Response Bond (ESER) issuance, but at the City's current pace it will take approximately 35 years or more to build out a HP AWSS pipeline system that serves all neighborhoods, including the southern portions of the City.[23] The City does not have a plan with a firm timeline for completion of this work or firm plans to fund all the work that needs to be done.

C. Problem Statement

Certain parts of the City, such as the northeast quadrant, are well protected against the risk of fires following an earthquake. These well-protected areas have a multi-sourced, redundant, Emergency Firefighting Water System (EFWS), including the HP AWSS. Unfortunately, other parts of the City are protected only by the low-pressure MWSS and by cisterns, which are not

[20] The 1986 Ballot Simplification Committee Analysis explained the proposal for Proposition A as paying for improvements including extending the high-pressure system and installing a high-pressure pump station at Lake Merced. Proposition A passed, but large areas of the City still do not have the protection of the independent high-pressure water system, and Lake Merced still does not have a high-pressure pump station. A copy of the Analysis by the Ballot Simplification Committee of the 1986 Proposition A is attached as Appendix L.

[21] 2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf, at p. 2.

[22] Neighborhoods currently without HP AWSS hydrants include Bayview Heights, Crocker Amazon, Excelsior, Ingleside, Merced Manor/Parkside, Mission Terrace, Oceanview, Outer Mission, Outer Richmond, Outer Sunset, Portola, Sea Cliff, Stonestown, and Sunnyside. A map showing the current layout of HP AWSS pipelines is on the cover and is attached as Appendix I.

[23] March 4, 2019 and March 11, 2019 SFPUC presentations and accompanying materials provided to the Emergency Firefighting Water System Management Oversight Committee. The amount of funding potentially available through the 2020 ESER bond and through water rates has been increased since the March 2019 Emergency Firefighting Water System Management Oversight Committee meetings. Thus, it *may* now be somewhat less than the 35 years presented in March. It has been difficult to tie down the City's "pace of funding" given there are no firm long term plans and the amount of funding available through an ESER bond can and does change. Although 35 years may be off somewhat, it remains the best (indeed only) current articulation of pace of funding and a timeline provided to the Civil Grand Jury.

nearly as reliable for fighting fires following a major earthquake and, unlike the HP AWSS, need fire engine support to effectively deliver water to a fire.[24]

The problem addressed in this report is how to ensure that all parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – are well protected from fires following earthquakes before it is too late.

METHODOLOGY

Members of the Civil Grand Jury conducted interviews with representatives of:

- The San Francisco Public Utilities Commission
- The San Francisco Fire Department
- The San Francisco Department of Public Works
- The San Francisco Office of Resilience and Capital Planning
- The San Francisco Department of the Environment
- The San Francisco Fire Commission
- The Board of Supervisors

Members of the Civil Grand Jury also conducted interviews with:

- Retired members of the San Francisco Fire Department
- A retired fire chief from a local jurisdiction
- Technical experts in the fields of engineering, wildfires, and water supply for fighting fires after earthquakes
- Concerned community members

Members of the Civil Grand Jury reviewed numerous planning and engineering reports specifically focusing on the AWSS or the PWSS, listed in Appendix D.

Members of the Civil Grand Jury also reviewed the relevant parts of articles, publications and reports regarding fires following earthquakes and related issues. These more general sources, some of which discuss the AWSS or PWSS but are not solely focused on them, are listed in Appendix E. [25]

---

[24] See discussion of expected problems of relying on a municipal water supply system in Section D of the Discussion, at pp. 18-20.

[25] Several of these publications are technical papers, and the Civil Grand Jury is comprised of lay citizens. When we cite or refer to technical papers it is generally for the conclusions or other non-technical information; we do not purport to be knowledgeable regarding the intricacies of fire spread models or the like.

DISCUSSION

Succinctly stated, "water supply is critical to firefighting."[26] Without a reliable water supply, the San Francisco Fire Department (SFFD) cannot be realistically expected to fight fires following a major disaster such as an earthquake.

A. San Francisco is Highly Vulnerable to Fires Following a Major Earthquake

San Francisco is highly vulnerable to fire after an earthquake, more than any other city in the country.

As explained in a 2008 article for the International Association for Fire Safety Science,

> Densely built environments are highly vulnerable to disasters. Common problems include: (a) narrow streets enabling fire to spread easily from one building to another; (b) streets cluttered with collapsed buildings in an earthquake restricting fire engine access; (c) shortage of open spaces which function as fire breaks or evacuation sites; (d) older and less robust wooden houses that easily collapse and burn in an earthquake ....[27]

San Francisco has significantly higher population density than any other county in California, as shown in Figure 1 on the next page: [28]

---

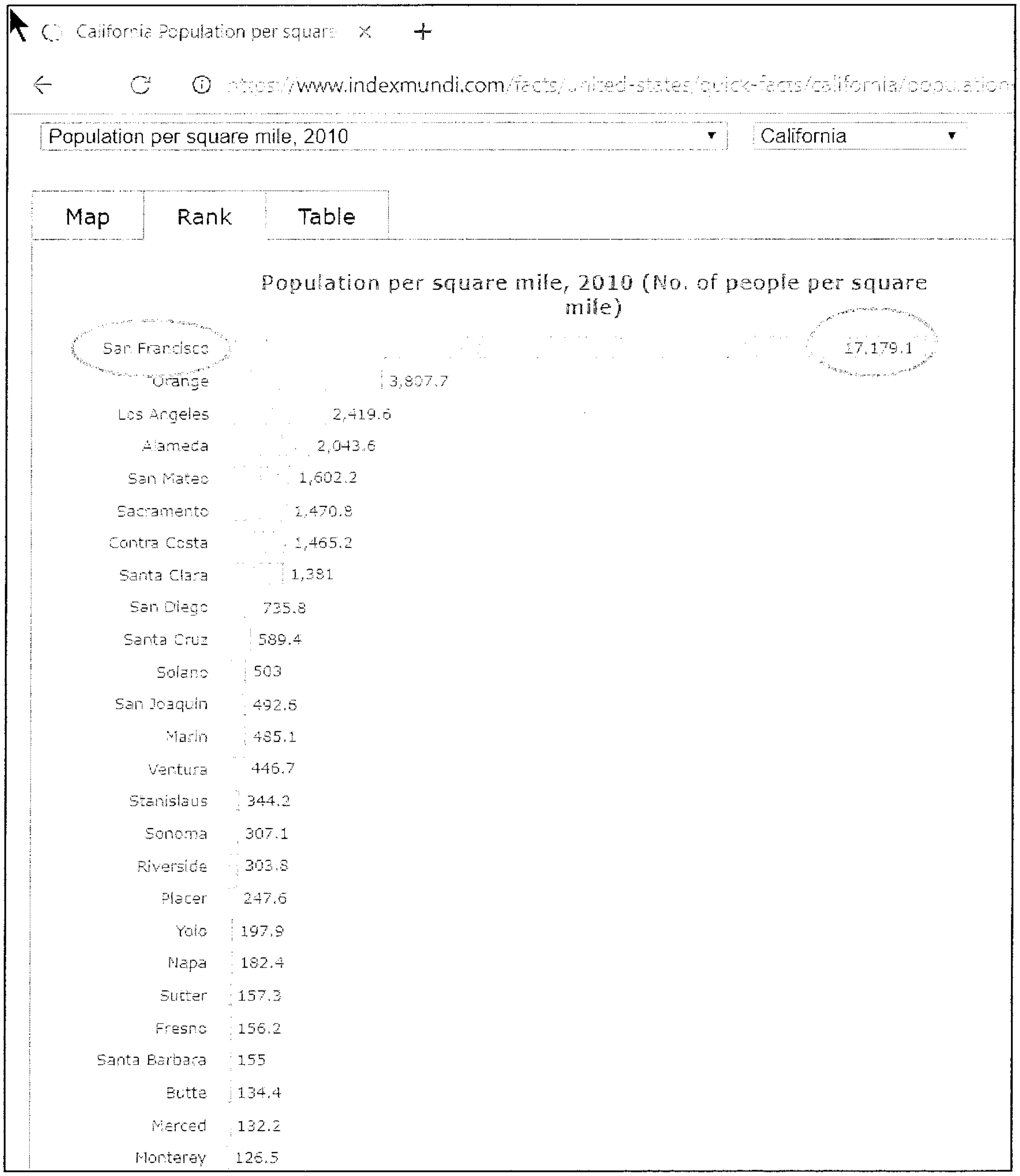
[26] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 12.

[27] Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf. at pp. 267-268 (parenthetical reference omitted). San Francisco does have streets that operate as fire breaks: Market St., Van Ness Ave., Geary St. (west of Gough), Dolores St., Mission St, 19th Avenue, Park Presidio Blvd., Alemany Blvd., and Third Street.

[28] See https://www.indexmundi.com/facts/united-states/quick-facts/california/population-density#chart .

Figure 1

Population Density By County



Similarly, based on 2016 data, San Francisco is the eighth densest city in the country with a population above 50,000, and other than New York City is the densest city with a population above 100,000:[29] See Figure 2, below.

Figure 2

Population Density by City

https://www.governing.com/gov-data/population-density-land-area-cities-map.html

Maps & Data - Geography - U.S. Census Bureau

- Passaic, N.J.: 22,424 persons/sq. mile

The following table lists population densities for U.S. cities with populations of at least 50,000 as of 2016:

Search:

City	Population Density (Persons/Square Mile)	2016 Population	Land Area (Square Miles)
Union City, New Jersey	54,138	69,296	1
West New York, New Jersey	52,815	53,343	1
Hoboken, New Jersey	42,484	54,379	1
New York, New York	28,211	8,537,673	303
Passaic, New Jersey	22,424	70,635	3
Somerville, Massachusetts	19,738	81,322	4
Huntington Park, California	19,561	58,879	3
San Francisco, California	18,581	870,887	47
Jersey City, New Jersey	17,860	264,152	15
Paterson, New Jersey	17,438	147,000	8
Cambridge, Massachusetts	17,316	110,651	6
East Orange, New Jersey	16,528	64,789	4

San Francisco also has many narrow streets, and buildings that will almost certainly collapse in an earthquake and obstruct many streets, blocking traffic including fire engines. We also have a heavy concentration of older, wooden homes that are densely concentrated and highly flammable.[30]

[29] https://www.governing.com/gov-data/population-density-land-area-cities-map.html.

[30] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

This is not just the Civil Grand Jury's perspective. Many experts, and numerous witnesses interviewed by the Civil Grand Jury, have opined that San Francisco faces "the most serious conflagration risk" and "will sustain major damage from fires following future earthquakes…."[31]

In July 2010, SPA Risk LLC (Dr. Charles Scawthorn, principal) prepared a report entitled, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, for the Applied Technology Council (ATC) on behalf of the City's Department of Building Inspection.[32] The report concluded that San Francisco is at "significant risk" due to fire following earthquake, and that the SFFD's fire engines[33] "will almost certainly not be able to respond to all post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for a magnitude 7.9 San Andreas event."[34]

A key table in that 2010 report is copied below:

Table 1

Bounds for Losses to Buildings Due to Fire Following Earthquake[35]

	25% - 75% Confidence Range		
	Ignitions	Loss $ billions	Total Burnt Building Floor Area Mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

31 See, e.g., Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf, at p. iii ("Scawthorn 1987"); ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at pp. vi, 25-29.

32 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf.

33 SFFD now has 44 frontline fire engines, and 19 relief engines, according to information provided by the SFFD. At the time of the 2010 report, the City apparently had 42 frontline engines.

34 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2. A copy of the Abstract (or summary) of that report is attached as Appendix K.

35 Ibid. These estimates already take into account the AWSS system as it existed in 2010 (i.e., prior to the addition of more cisterns and other work performed under the 2010 and 2014 ESER bonds). The damage estimates do not include business interruption losses, loss of tourism or loss of property tax revenues.

As explained in that report, there is significant uncertainty regarding how many fires might be ignited following an earthquake, and the extent of damage they are likely to cause. One of the key variables is completely outside the City's control: wind. In 1989, the City was extremely lucky that there was no wind.[36] Indeed, "stronger wind conditions would have resulted in much greater fire spread in the Marina…."[37]

According to the 2010 report, there is a 25% chance that fires and damages could fall below the ranges in Table 1 on the preceding page, and an equal likelihood that they could exceed the ranges in that table.[38] Earlier this year (2019) the San Francisco Public Utilities Commission (SFPUC) engaged Dr. Scawthorn to update his analysis, but that update will not be completed until after this report has been issued. However, the key is not the precise numbers but "their overall magnitude."[39] Indeed, given the escalation in Bay Area home values over the last decade, one can only assume that the dollar loss estimates will increase substantially.

B. The USGS Warns the San Francisco Bay Area Has a High Likelihood of a Major Earthquake

In 2014, the USGS estimated there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043.[40] This was based on a new model, commonly referred to as the third Uniform California Earthquake Rupture Forecast, or UCERF3.[41]

Small earthquakes occur more frequently than large earthquakes.[42] According to the updated model, the probability that an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent. By comparison, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent for the same area, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent. [43]

---

36 Scawthorn and Blackburn, Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990.

37 *Id.*, at p. 6.

38 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2, attached as Appendix K.

39 *Ibid.*

40 See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

41 UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

42 USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

43 UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

Table 2 below is a simplified version of a table from a USGS fact sheet showing the likelihood of one or more events of varying size for the San Francisco region within the next 30 years based on this new model:[44]

Table 2

San Francisco Region Section of Table from March 2015 USGS Fact Sheet 2015-3009

San Francisco Region		
Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events
5	1.3	100%
6	8.9	98%
6.7	29	72%
7	48	51%
7.5	124	20%
8	825	4%

Although these figures are for the region, and not just the City and County of San Francisco, the predictions are sobering. To put these predictions in perspective, the 1989 Loma Prieta earthquake had a magnitude of 6.9, and, even though the epicenter was approximately 60 miles from San Francisco, it was the largest earthquake to strike the City since 1906.[45] Using the USGS online calculator,[46] a 7.5 magnitude earthquake, which has a 20% chance of happening by 2043, would be almost four times bigger than Loma Prieta, and would release almost eight times the energy. An 8.0 magnitude earthquake would be over 12.5 times bigger than Loma Prieta, and would release almost 45 times the energy. And this is without addressing the risk that the next major earthquake's epicenter could be much closer than 60 miles away.

---

[44] *Id.*, at p.4; Table 2 above is a simplified version of Table 1 of Fact Sheet 2015-3009, attached as Appendix F.

[45] See USGS, M 6.9 October 17, 1989 Loma Prieta Earthquake, https://earthquake.usgs.gov/earthquakes/events/1989lomaprieta/; USGS, M 6.9 - Loma Prieta, California Earthquake, https://earthquake.usgs.gov/earthquakes/eventpage/nc216859/executive.

[46] See USGS, "How Much Bigger ....?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can calculate how much bigger one earthquake is than another.

The USGS has also warned that the pace of large earthquakes is likely to increase:

> In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.[47]

The warnings and predictions from the USGS should be a wake-up call to all of us.

C. The Existing High-pressure AWSS System Only Covers Part of the City

The history and condition of the existing HP AWSS have been described in detail in multiple other reports.[48] Figure 2, on the following page, shows the location of the HP AWSS:[49]

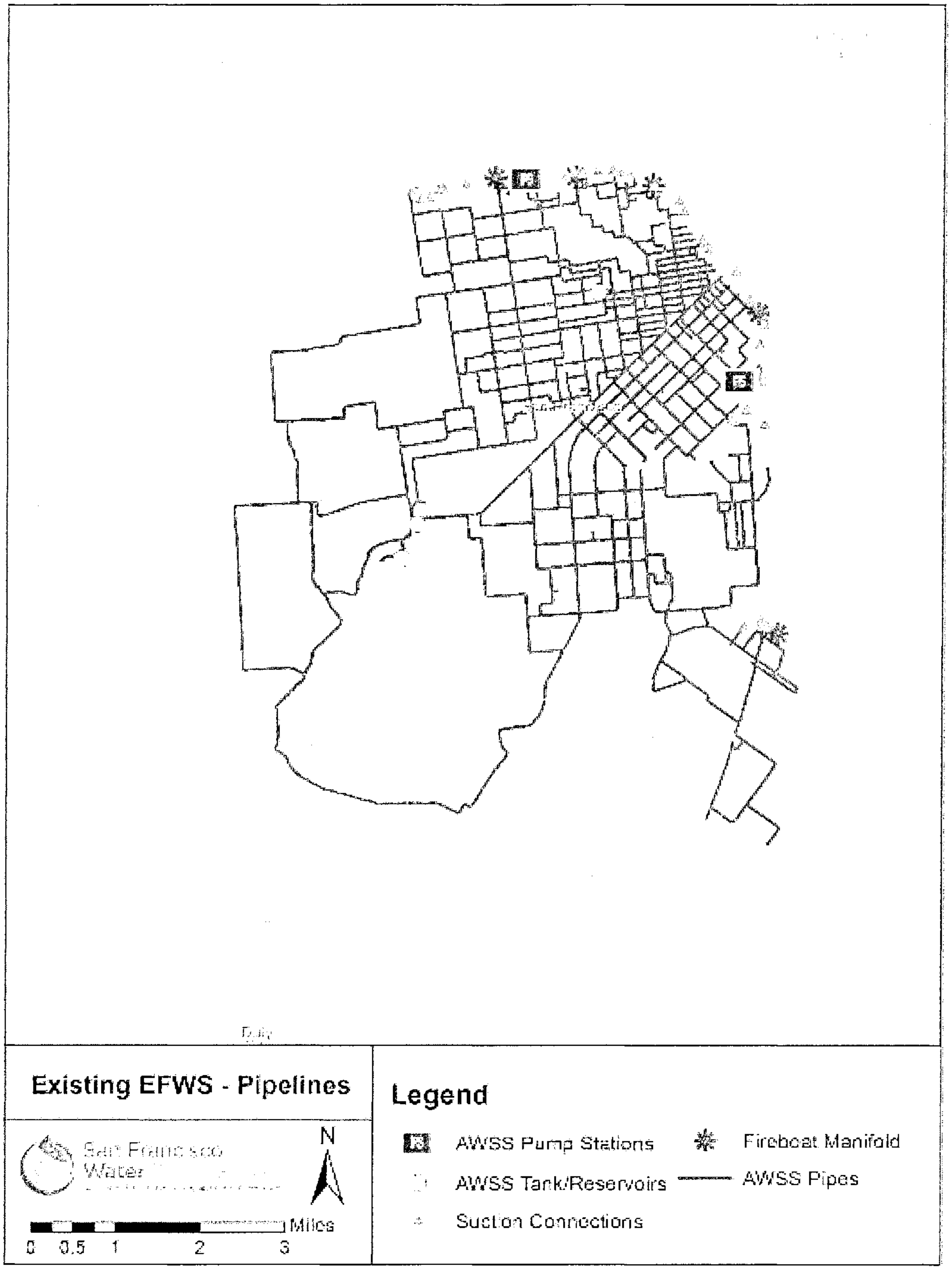
---

[47] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf . See also Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517; *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[48] See, e.g., CS-199, at pp. 7-11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7 .

[49] Map supplied by the SFPUC on May 7, 2019.

Figure 3
Map of Existing High-Pressure AWSS



On a district by district basis, Supervisorial Districts 1, 4, 7 and 11 are not nearly as well protected by the HP AWSS as, for example, Districts 3 or 6:[50] See Table 3 below.

Table 3
HP AWSS Hydrants and Miles of Main by District

Supervisorial District	# of AWSS Fire Hydrants	Miles of AWSS Mains
1	42	5
2	170	14
3	327	23
4	3	0
5	188	16
6	366	27
7	79	7
8	110	9
9	110	9
10	222	18
11	24	1
TOTAL	1641	130

In fact, six of the eleven Supervisorial Districts, Districts 1, 4, 7, 8, 9 and 11, each have less than ten miles of AWSS mains. Districts 1, 4, and 11 each have less than 50 AWSS fire hydrants.

The areas not protected by the HP AWSS would need to rely primarily on getting emergency firefighting water supplies from the City's MWSS through its low-pressure hydrants or from cisterns. For a number of reasons detailed below, these resources are unlikely to provide adequate water to protect residents from fires after a major earthquake.

[50] Data provided by SFPUC on March 13, 2019.

D. The Municipal (Domestic) Water Supply System Is "Highly Vulnerable to Catastrophic Failure"[51]

No one knows with certainty what will happen in a major earthquake. But common sense says we should look at past experience and listen to experts when they warn us not to rely on the MWSS for firefighting following an earthquake.

As explained in a 2009 report prepared for the SFPUC,

> By their nature, domestic water mains are more vulnerable to earthquake damage. Numerous service connections and the jointed construction that is the industry norm contribute to their vulnerability.[52]

San Francisco has made a tremendous effort to improve and seismically reinforce its regional and local water system by means of the $4.8 billion Water System Improvement Project (WSIP).[53] The WSIP is one of the largest water infrastructure programs in the nation and the largest infrastructure program ever undertaken by the City. Among its objectives has been reducing the water system's vulnerability to earthquakes, with a particular emphasis on seismically reinforcing the regional delivery system, transmission mains, and reservoirs.[54]

Although the WSIP greatly enhances the reliability of the MWSS, and in particular the transmission mains and reservoirs, the 2009 report emphasizes that, unlike the HP AWSS, the local MWSS system is vulnerable to a major earthquake due to the numerous branches and service connections that can break and drain the system.[55]

This has been borne out by experience in San Francisco and elsewhere. In the 1906 earthquake, an estimated 23,000 breaks in the MWSS resulted in the loss of water and pressure.[56] In the much smaller 1989 Loma Prieta earthquake, there were 69 main breaks and 54 service

---

[51] See SF Fire Commission Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf at p.1. A copy of SFFC Resolution 2010-01 is attached as Appendix M.

[52] Metcalf & Eddy, at p. 18, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The SFPUC has initiated a planning study to better understand the current level of reliability of the entire potable distribution system, focusing on backbone pipes, but that study will take several years to complete.

[53] See SFPUC's WSIP webpage, https://sfwater.org/index.aspx?page=114 .

[54] See, e.g., list of WSIP projects at https://sfwater.org/index.aspx?page=968 .

[55] Metcalf & Eddy, at pp. 18-19, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The Civil Grand Jury is not questioning the importance or the efficacy of the WSIP, which is essential to rapidly restoring potable water service to residents following an earthquake. But fire suppression needs an immediately available supply of water, which the MWSS is unlikely to be able to provide following a major earthquake.

[56] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, p. 6. Other reports have provided somewhat different, but still extremely high estimates. Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 13 [over 28,000 breaks, including service breaks]. But whatever the precise number of water main breaks in 1906, the earthquake devastated the water supply system which contributed to the horrific fires that nearly destroyed the City.

connection breaks in the Marina district alone.[57] Because of these breaks, low-pressure hydrants located in the Marina could not provide adequate water or pressure for firefighting.[58]

Other recent major earthquakes have also caused substantial damage to municipal water supply systems. In the 6.7-magnitude 1994 Northridge earthquake, there were over 1,000 water main breaks and over 100 fires.[59] In the 6.9-magnitude 1995 Kobe, Japan earthquake, "water loss seriously impaired firefighting."[60] There were over 2,000 breaks in the underground piping, and large fires burned freely due to lack of water.[61] Similarly, in the 2011 Eastern Japan earthquake there was extensive damage to water supply lines.[62] Even the relatively small 6.0-magnitude 2014 South Napa earthquake "highlighted the vulnerability of water and wastewater systems to earthquake-related ground failure, the additional fire hazards that earthquake-related water system failures can pose, and the fiscal challenges that public agencies face in improving the seismic resiliency of these systems, both pre- and post-earthquake."[63]

Experts have predicted that in a future major San Francisco earthquake, the MWSS could sustain over 1,000 breaks.[64] Various reports have said it in different ways, but the clear takeaway is that the MWSS should not be relied upon to save the City from fires following a major earthquake:

- "MWSS pipes will sustain damage in certain areas of the City, which will impair the ability to deliver water for firefighting."[65]
- "In such an emergency it is likely that the potable water distribution system would be compromised by pipe breaks and leaks."[66]

---

[57] CS-199, at p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; see also O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996) ("O'Rourke, Lessons Learned").

[58] Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

[59] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 16; O'Rourke, Lessons Learned, at p. 3.

[60] O'Rourke, Lessons Learned, at p. 3.

[61] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 18-19.

[62] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 24.

[63] Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf, Finding 2.3, at p. iii.

[64] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2.

[65] CS-199, p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

- "...the usual firefighting water supplies will almost certainly fail...."[67]
- "World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake."[68]

Moreover, unlike AWSS hydrants, low-pressure hydrants connected to the MWSS require a fire engine to extract and pump the water to sufficient pressure for firefighting.[69] Given that fire engines are likely to be in high demand and potentially overwhelmed in a major earthquake, this is yet another reason why an alternative source of water is necessary.[70]

E. Cisterns Provide Limited Protection

Cisterns are underground tanks, unconnected to any water source.[71] Typically, cisterns in San Francisco hold approximately 75,000 gallons of water.[72]

The City has 229 cisterns located throughout the City, as shown by Figure 4 on the next page[73]:

---

66 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

67 PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 39.

68 SFFC Resolution 2010-01, p. 1, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf and attached as Appendix M.

69 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 55-56.

70 Scawthorn, O'Rourke & Blackburn, 1906 Lessons, at pp. S153-1S54, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf .

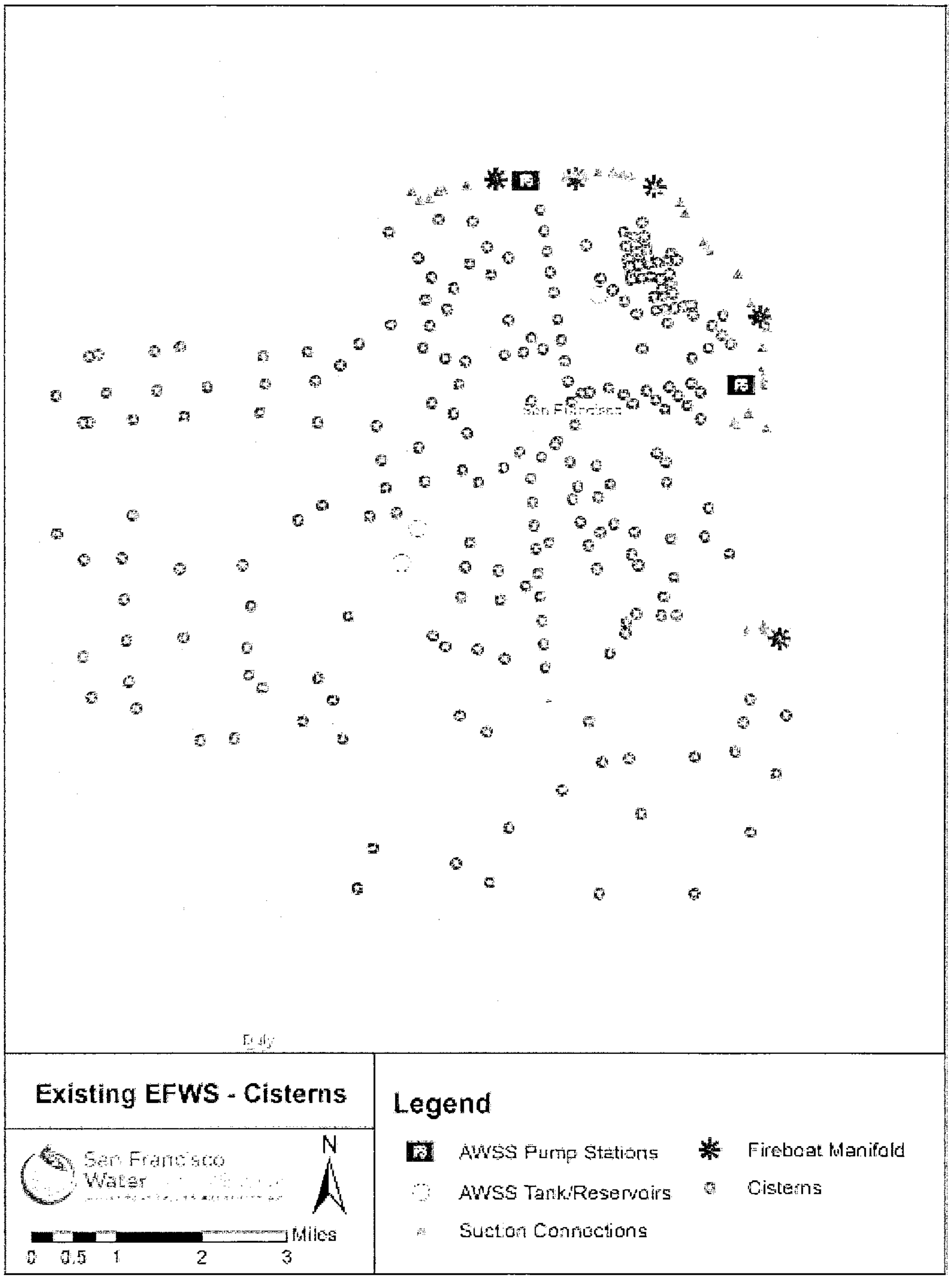
71 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at p. 13.

72 See SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 6.13-6.17; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at p. 77.

73 Map provided by SFPUC on May 7, 2019.

Figure 4

Map of Existing Cisterns



By Supervisorial District, the breakdown of cistern locations is listed in Table 4 below.

Table 4

Cisterns by Supervisorial District

Supervisorial District	Cisterns
1	17
2	23
3	46
4	12
5	20
6	26
7	12
8	27
9	21
10	20
11	5
TOTAL	229

Notably, Districts 1, 4, 7 and 11, which currently have the fewest miles of HP AWSS pipelines, also have the fewest cisterns. This is especially true of District 11, with only one mile of AWSS main pipeline and only five cisterns. [74]

Cisterns provide a valuable backup or "last resort" in the event of damage to the MWSS and AWSS. In the 1994 6.7-magnitude Northridge earthquake, the MWSS suffered over 1,000 water main breaks.[75] Firefighters used backyard swimming pools as water supply sources. In the 1906 earthquake, San Francisco's 23 cisterns were credited with saving a major building in the Financial District when the water mains broke.[76]

Cisterns, however, have limited capacity[77] and are therefore unlikely to be effective against serious fires following a major earthquake. In the 1995 6.9-magnitude Kobe earthquake,

---

[74] In recent years, the SFPUC has built 30 additional cisterns, funded by the 2010 and 2014 ESER bonds. These 30 new cisterns are included in the totals in the above table. Half of these new cisterns were strategically located in the Richmond and Sunset districts, which now have 17 and 12 cisterns, respectively, to begin to address concerns that those areas of the City were inadequately protected. SFPUC 2017 FAQ, Question 4, https://sfwater.org/modules/showdocument.aspx?documentid=11507 .

[75] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at pp. 12-17.

[76] Scawthorn 1987, http://www.sparisk.com/documents/AIRACFFEs.pdf , at p. S140.

[77] SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 5.6-5.7.

however, the city's 968 cisterns provided little help to firefighters because they drained in 10 minutes.[78]

San Francisco's typical cistern would drain within an hour of continuous firefighting.[79] Given that on average it takes several hours to put out a four-alarm fire,[80] cisterns cannot be expected to successfully fight post-earthquake conflagrations in parts of the City not protected by AWSS. In addition to providing limited firefighting water, cistern water must be extracted and pressurized by an engine, requiring more staff and time to deploy than, for example, AWSS hydrants.[81]

F. The PWSS Inventory Needs to Be Modernized and Expanded

In addition to the MWSS and cisterns, the SFFD intends to rely on the City's Portable Water Supply System, or PWSS, to fight fires in non-AWSS areas.

In the 1980s, the SFFD developed and implemented the PWSS, an above-ground, large-diameter hose system used to move water great distances from a water source to a fire. PWSS units consist of a hose tender, or truck, equipped with approximately one mile of large-diameter five-inch hose (larger than the normal three-inch hose), along with a portable pump, portable hydrants that allow water to be distributed from a large-diameter hose, and other essential firefighting equipment.[82] With its portable pump, a hose tender can be used to draft and pressurize water from alternative water sources, such as lakes, lagoons, a fireboat (as in the 1989 Loma Prieta earthquake), cisterns, or even broken water mains. It can also be used to extend the reach of the HP AWSS system to blocks or neighborhoods without a HP hydrant.[83]

---

[78] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 17-19. San Francisco's cisterns are larger than Kobe's, but the point remains they are only good for a limited duration. *Id.*, at p. 77.

[79] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 77.

[80] Information provided by SFFD.

[81] CS-199, at pp. 13, 56, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[82] Scawthorn, O'Rourke, Blackburn, S150-151. A detailed description of the PWSS can be found in Scawthorn, C. and Blackburn, F. (1990), Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC. The PWSS and its five-inch hoses are different from a prior, abandoned concept of a Flexible Water Supply System, using massive, 12-inch hoses in lieu of expanding the HP AWSS. That concept was proposed in AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246. It was abandoned as impractical after concerns over, among other things, how 12-inch diameter hoses would block traffic.

[83] Figure 6-1 on page 83 of CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, is a map of the City showing how the PWSS can be used to expand the areas protected by the AWSS. Figure 6-1 assumes certain extensions of the AWSS

Currently, there are only five PWSS hose tenders, three of which are located in the "unprotected areas"[84] of the Sunset district and Hunter's Point. In the SFFD's opinion, the PWSS hose tenders are "past their useful life."[85] The newest hose tender, housed in the Sunset, is 27 years old. The second newest, in Hunter's Point, is over 30 years old. The remaining three are over 45 years old.[86]

Firefighters and emergency response experts have been calling for a large-scale expansion of the PWSS for years.[87] In January 2010, the San Francisco Fire Commission (SFFC) issued Resolution 2010-01, encouraging the SFFD to pursue approximately $10 million in grant funding to expand the PWSS. The SFFC recognized that the City's MWSS is highly vulnerable to a catastrophic failure in the event of a major earthquake, and that the AWSS does not cover the entire City. The SFFC declared that the PWSS has been proven effective in the above-ground transmission of water for firefighting, that the PWSS can work in conjunction with and supplement the AWSS, and that the City did not have a sufficient number of units to supply all areas of the City where the AWSS does not extend.[88] Unfortunately, that grant was not funded, and the City has not yet purchased any additional PWSS hose tenders.[89]

Also in 2010, the Applied Technology Council issued several reports as part of the City's Community Action Plan for Seismic Safety, or the "CAPSS Project."[90] Among its recommendations was one similar to ours: Improve emergency water supply systems to cover those neighborhoods not served by the HP AWSS. As explained in that report,

> The Auxiliary Water Supply System provides a redundant water system for fighting fires after earthquakes and at other times, and incorporates many earthquake resistant features in its design. However, this system covers only northern and eastern City neighborhoods, those that were developed in the early

---

that do not presently exist, and does not take into consideration the limited size of the existing PWSS inventory. As a result, Figure 6-1 in CS-199 overstates the current level of protection, but does show what could be accomplished with a larger inventory of PWSS hose tenders.

[84] These areas are of course not completely unprotected, but as discussed above they do not have a HP AWSS. The City's outside expert AECOM/AGS, A Joint Venture, has referred to the portion of the City protected by the HP AWSS as the "Protected Area." See CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[85] Information provided by SFFD.

[86] Information provided by SFFD.

[87] See Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990, attached as Appendix Q.

[88] SFFC Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf

[89] Information provided by SFFD.

[90] According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts. See https://sfgov.org/esip/capss .

> part of the last century when the system was constructed. *The City needs adequate, reliable water sources to fight post-earthquake fires in all neighborhoods. There are a number of options to improve the water supply in neighborhoods not served by the Auxiliary System, including expanding the City's Portable Water Supply System, which can be deployed wherever needed. This important issue needs to be addressed as soon as possible.* (Emphasis added)[91]

In 2014, outside consultant AECOM/AGS, a Joint Venture, advised the City that "[a]dditional PWSS units would be a prudent investment for SFFD/SFPUC."[92]

The SFFD submitted a request for funding to purchase 20 newly designed PWSS hose tenders in the fiscal year 2019/2020 budget, but the Civil Grand Jury understands that only four new PWSS hose tenders are included in the Mayor's May 31, 2019 two-year budget proposal.[93] The proposed new SFFD hose tenders are designed to be more efficient and maneuverable than older models, with four-wheel drive to overcome obstacles on roads, the ability to carry up to 6,000 feet of five-inch fire hose, and only one firefighter required to operate each vehicle. Each vehicle will have a high-volume onboard water pump, and a portable submersible water pump. Both pumps will be able to draft water from the Bay, reservoirs, or other water sources. These new hose tenders could be connected together to carry water over many miles of the City. The SFFD estimates these new PWSS vehicles, fully equipped with hoses and appliances would cost approximately $1 million per vehicle.[94]

Given the time required to build or extend a HP pipeline system, acquiring additional PWSS hose tenders is a practical intermediate step to enhance fire protection throughout the City. The SFFD advised the Civil Grand Jury that additional PWSS hose tenders could be acquired and in service within a year or so, or at the outside two years. The failure to obtain grant monies should not stop the City from making this important investment in public safety.

Although the Civil Grand Jury recommends immediately replacing and expanding PWSS units, this is not a long-term solution. A successful PWSS deployment requires a nearby water source, and personnel to unwind a mile of heavy, five-inch-diameter hose through potentially

---

[91] Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety (2010), prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project, at pp. 53-54, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

[92] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 85. Although this report referred to the PWSS as an investment in the colloquial sense, the PWSS is not a fixed asset and thus does not involve a capital expenditure. As such, purchasing new hose tenders will need to come from city funds, not bonds. The Civil Grand Jury nevertheless believes that acquiring more PWSS hose tenders is long overdue.

[93] Information provided by SFFD. The City's budget process is of course ongoing. It is therefore uncertain whether the Board of Supervisors will approve sufficient funding for the four new units or conversely whether the Board of Supervisors will increase the funding for purchasing new PWSS units. We also understand that a request for funding for PWSS hose tenders has been made to state officials, but at this time the SFFD does not know if that request has been approved.

[94] Information provided by SFFD.

congested and damaged city streets. [95] Moreover, although hose tenders can draft water from the Bay, they are not designed for use in the ocean – the only unlimited water source on the west side of the City.[96] Given these challenges, PWSS is essentially an important but temporary "Plan B."

G. Efforts to Expand the High-Pressure AWSS Need to Be Accelerated

As discussed in Section B above, the USGS estimates there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area before 2043.[97] In early April of 2019, USGS researchers issued a new study warning that "the next 100 years of California earthquakes along [the San Andreas, San Jacinto and Hayward] faults could be a busy one."[98] Each year we delay construction of an expanded HP AWSS we are gambling, pushing our luck that a major earthquake won't hit before we're ready.

City departments, including the SFPUC, which assumed jurisdiction over the operation and maintenance of the AWSS from the SFFD in 2010, have been analyzing the reliability of the EFWS and the possible expansion of the HP AWSS for over a decade.[99] An analysis in 2009 indicated that the EFWS was "47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake."[100] In actuality, and as discussed in Section I below,[101] the SFPUC's consultant's metric is overly optimistic: a 50% score really means that we will have about half of the water needed to meet *median* firefighting demands following a 7.8-magnitude earthquake. Put differently, if the firefighting demands are above the median estimate, this analysis indicates that even with a score of 99% there will be insufficient water to meet the demand.

---

[95] Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, at pp. 4-5; information provided by SFFD.

[96] According to the SFFD, there is no known SFFD access to the ocean on the western side of the City, but SFFD is continuing to investigate potential access areas where it might be able to use a PWSS unit.

[97] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020, https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

[98] See *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[99] See e.g., Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, CS-199 (2014), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229 (2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, 2018 Westside Options Analysis (2018), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, among other reports.

[100] SFPUC FAQ, Question No. 3, https://sfwater.org/modules/showdocument.aspx?documentid=11507 and attached as Appendix N.

[101] See pages 35-36 below.

Figure 5, below, shows EFWS reliability by so-called Fire Response Areas (FRAs)[102] as of 2010, i.e., prior to recent improvements.

Figure 5
Map of EFWS Reliability Scores by FRA as of 2010[103]

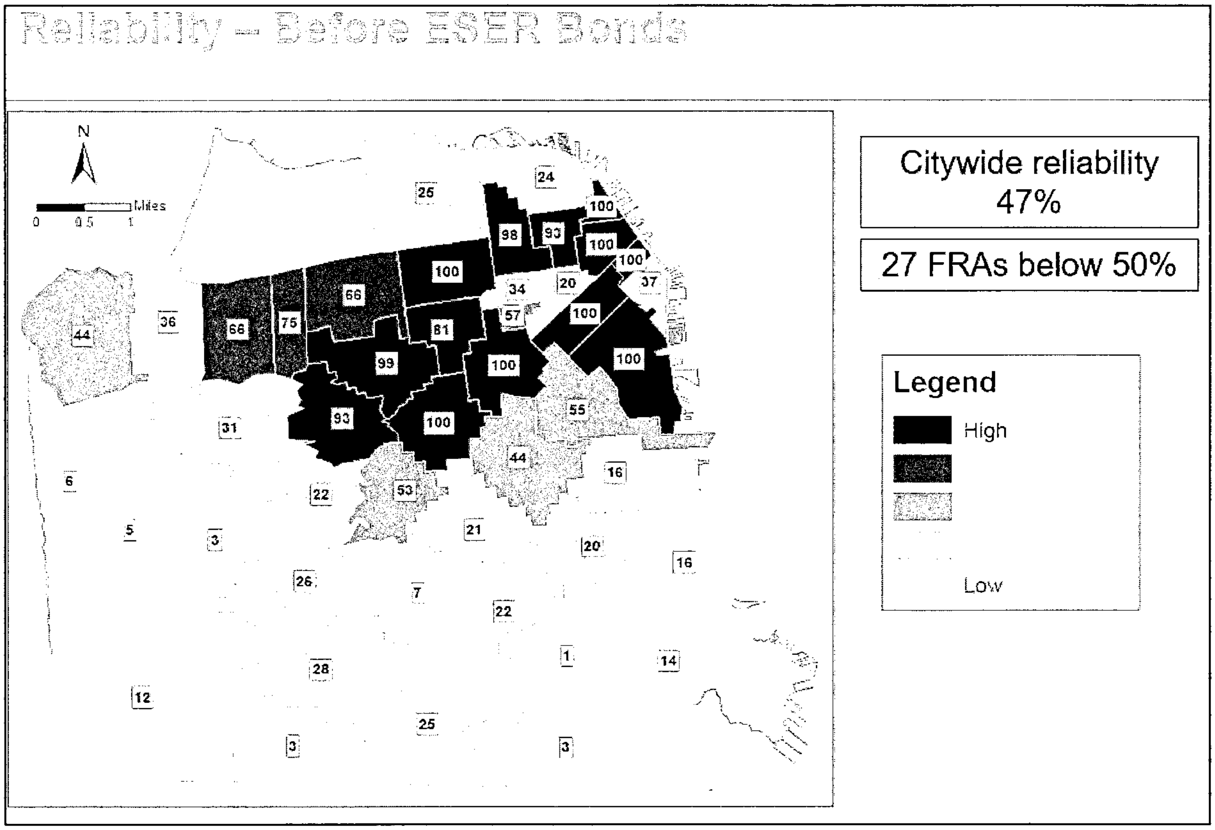


Figure 5 shows that as of 2010 the majority of the City scored below 50%, and in some cases far below. In 2010 and again in 2014, voters approved Earthquake Safety and Emergency Response (ESER) Bonds. The 2010 ESER bonds provided approximately $102 million for the EFWS, and the 2014 ESER bonds provided $54 million. The money was spent on assessing the existing HP AWSS, rehabilitating and upgrading core facilities (existing water storage tanks, pipelines, salt-water pumping stations) that needed seismic strengthening or other repairs or improvements, adding 30 cisterns, and other tasks.[104]

---

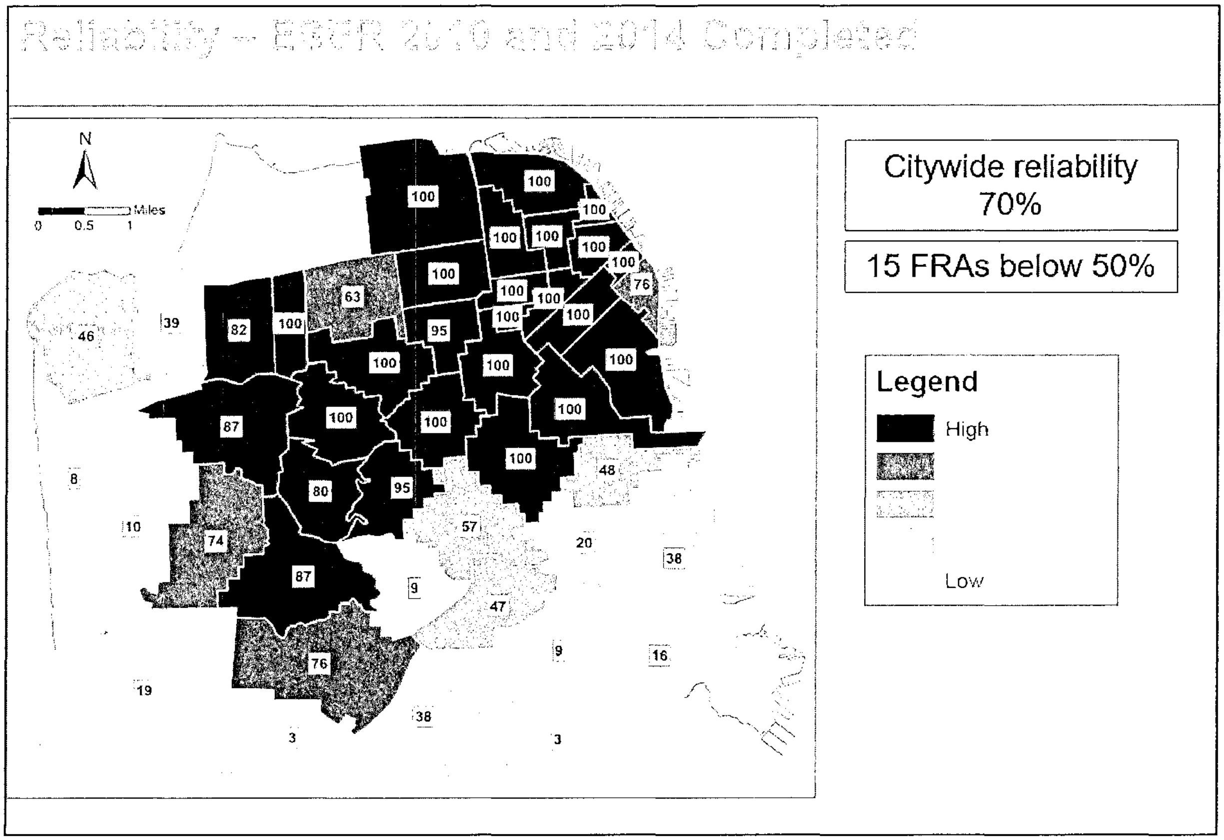
[102] The SFFD divides the City into 46 areas for initial alarm response, also referred to as Fire Response Areas or FRAs. A map showing the different FRAs is attached as Appendix J.

[103] Map supplied by SFPUC. Identical map, except for legend, in AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907 at p.3.

[104] A February 26, 2019 status list provided by the SFPUC for the various projects undertaken pursuant to the 2014 and 2014 ESER bonds, showing which are in planning, in design, in construction, complete, canceled or

The result has been significantly improved EFWS reliability scores, as shown by Figure 6:

Figure 6
Map of EFWS Reliability Scores by FRA After 2010 and 2014 ESER Bond Work Completed [105]



The SFPUC has performed important work in analyzing what needs to be done and by repairing existing facilities. *But today, nine years after the 2010 CAPSS report called for action as soon as possible, 16 years after the 2002-2003 Civil Grand Jury called for expanding the HP AWSS to the entire City, almost 33 years after the 1986 Fire Protection Bonds Analysis stating*

postponed is attached as Appendix O. See also Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found at http://www.sfearthquakesafety.org/eser-reports.html

[105] This map assumes completion of work in progress, which is expected by late 2020 according to the SFPUC. The SFPUC has retained outside experts to update the anticipated water demands by FRA but that work has not been completed.

the improvements would include extending the HP AWSS and installation of a HP pump station at Lake Merced, and over a hundred years after the AWSS system was first built, we are still decades away from reliably protecting all neighborhoods.

Over the past year, the SFPUC has made substantial progress in developing plans to improve EFWS on the west side. Specifically, the SFPUC and the SFFD propose to develop a new, separate AWSS system using potable water ("Potable AWSS") for the western part of the City. The Potable AWSS approach contemplates a dual-purpose pipeline, independent from the existing HP AWSS network.[106] The Potable AWSS would function as a potable water transmission main during normal operations and would provide HP emergency firefighting water supply for major fires. The new pipeline would provide "daily reliability and water quality benefits as well as a post-earthquake potable water supply to the Richmond and Sunset districts",[107] but in the event of an earthquake or other emergency, the transmission main would automatically be isolated from the remainder of the potable distribution system and converted to a dedicated HP system, similar to the existing or conventional AWSS.[108] To increase reliability, the new pipeline would be made of modern, seismically reliable material.[109]

The SFPUC currently anticipates having approximately $195 million,[110] from water rates and from an expected 2020 ESER bond (assuming voter approval), to spend on extending the HP AWSS and improving EFWS reliability over the next five to seven years.[111] The current Potable AWSS proposal is divided into two phases, as the projected $195 million is insufficient to

---

[106] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at pp. 7, 10, 13.

[107] *Id.*, at p. 8. The Potable AWSS would eliminate the need for a project that the SFPUC had been planning to supply potable water to the Richmond District, saving up to $30 million. *Id.* Today the potable water supply to the Richmond District depends on two transmission mains that run north from the Sunset District. One of those mains was built in 1915. The other was recently replaced with a ductile iron main. The Potable AWSS would provide a third transmission main, built with modern earthquake resistant pipe. *Id.*, at p. 13.

[108] A detailed description of the Potable AWSS concept can be found in CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229, https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, and 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740. The actual proposal has evolved over time, so the alignment discussed in those 2014, 2015 and 2018 reports has changed, as have the water sources. This plan is still under review and the alignment may well change again before the plan is finalized and ready for any required public hearings or environmental or other review. But the underlying concept of a Potable AWSS and how it would operate remains the same.

[109] New pipe would be so-called Earthquake Resistant Ductile Iron Pipe (ERDIP), the most seismically reliable pipe available. ERDIP pipe performed admirably in several recent Japanese earthquakes See Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 6, re ERDIP pipe.

[110] Information supplied by the SFPUC. The $195 million is adjusted for inflation as the build out will occur over several years. This is roughly equivalent to $160 million in 2018 dollars according to the SFPUC.

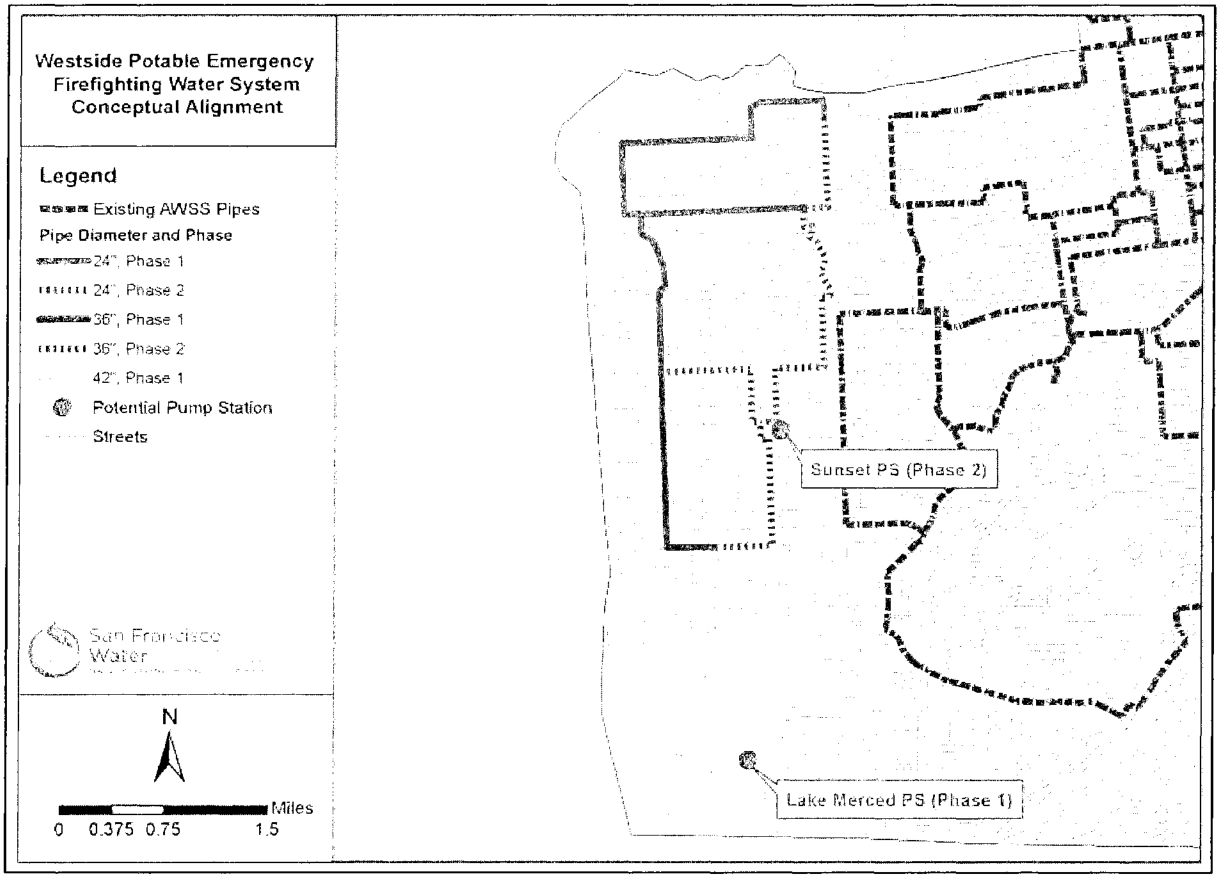
[111] Meetings with SFPUC representatives. The Board of Supervisors approved the 2020-2029 ten-year Capital Plan at its April 30, 2019 meeting. See https://sfbos.org/sites/default/files/bag043019_minutes.pdf . The new ten-year Capital Plan can be found at http://onesanfrancisco.org/the-new-plan/overview .

complete the entire project. Phase 1 involves adding approximately 8.6 miles of new pipe.[112] A conceptual potential pipe alignment would extend north from Lake Merced along the west side, through the western portion of the Sunset and Richmond districts, and then have two pipelines head east, one immediately south of the Presidio and one in the southern Richmond district.[113]

A conceptual potential alignment of both Phase 1 and Phase 2 is shown in Figure 7 below:[114]

Figure 7

Conceptual Potential Alignment for Potable West Side AWSS



[112] Information provided by SFPUC. The phasing and the potential, proposed or conceptual alignment discussed above and on the following pages are still in the planning stages and are subject to change. Detailed designs have not yet been completed, much technical analysis remains to be done, and the project has not yet undergone environmental reviews.

[113] The current furthest west AWSS pipeline is located east of Park Presidio Boulevard.

[114] Provided by the SFPUC on April 10, 2019. See footnote 121 on page 32.

The Potable AWSS pipeline network would tie into an existing, recently seismically reinforced, potable 60-inch transmission main, providing a source for normal, potable-water operations.[115] The proposed Phase 1 also includes adding a new HP pumping station at Lake Merced.[116] Although the water in Lake Merced is deemed non-potable, Lake Merced contains approximately a billion gallons or more, making it an excellent source of water for emergency firefighting purposes.[117]

The SFPUC and SFFD's future west side plans (Phase 2) include an additional 5.6 miles of pipeline for better coverage and potentially an additional pumping station at Sunset Reservoir, for another source in case of a broken pipe or other emergency.[118] However, the SFPUC and the SFFD do not anticipate having the additional approximately $120 million[119] needed to complete that portion of their plan until the next round of ESER bonds, which may not be for another five to seven years or even longer.[120]

Unfortunately, the Potable AWSS on the west side only addresses the EFWS deficits on the west side of the City. Many other City neighborhoods along its southern part, from Park Merced in the west to Visitacion Valley in the east, will be no closer to having a multi-sourced, seismically reliable HP AWSS or substantially enhancing their neighborhood's EFWS even if this westside Potable AWSS plan moves forward.

---

115 According to the SFPUC, this transmission main connects to both (a) the Crystal Springs Reservoir in San Mateo County and to the 9'6" Crystal Springs Bypass tunnel, which is supplied by Calaveras Reservoir, San Antonio Reservoir, and the SFPUC's upcountry water sources (Hetch Hetchy, Don Pedro, etc.). These potable water sources were seismically reinforced by the SFPUC's Water System Improvement Program (WSIP), a $4.8 billion program to improve water system reliability, including seismic reliability. See SFPUC webpage on WSIP, https://www.sfwater.org/index.aspx?page=114 .

116 Like the conceptual potential pipeline alignment, the size, location and design of any new pumping station is at present unknown and uncertain. The Civil Grand Jury understands that the Potable AWSS project is currently moving forward with design, technical studies, environmental and management reviews, but is of course also dependent upon approval of necessary funding.

117 Information provided by SFPUC; see also V. Matuk and N. Salcedo, Lake Merced Hydrology and Water Quality, http://online.sfsu.edu/bholzman/LakeMerced/water.htm ("Estimates of the capacity of the lake also vary greatly from a low of 768 million gallons to high of 1.93 billion gallons."). The Sunset pumping station shown in the figure on the preceding page is being considered as a potential part of Phase 2.

118 Per the SPFUC, the Sunset Reservoir Pumping Station will also be connected to a seismically reinforced, potable 54-inch transmission main. Unlike the northeast quadrant, where the AWSS pipeline system is a grid and thus provides an excellent measure of redundant support in case of a broken pipe, the proposed Potable AWSS would not be a grid. The lack of redundant pipelines creates a somewhat higher level of risk. However the use of modern ERDIP significantly reduces the risk of pipeline failure, and having redundant water sources provides additional comfort as it would enable back-feeding and reduces the risk of a potential single point of failure. 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

119 This cost estimate is in 2018 dollars. Unless otherwise stated, all cost estimates provided by the SFPUC, SFFD and SFDPW to the Civil Grand Jury for work on the EFWS system and discussed in this report are in 2018 dollars.

120 Even if new bonds are issued in five to seven years, design and construction of the new pipelines and new pumping station would take several more years.

The limited scope of the SFPUC's current plans is the result of budgetary constraints. The Mayor and the Board of Supervisors determine what bond proposals are placed before the voters, how frequently, and what is included. The SFPUC and the SFFD must operate within the financial constraints they are given.

The SFPUC has rough estimates showing that extending the high-pressure AWSS throughout the City–or building separate but functionally equivalent Potable AWSS systems in areas without a HP AWSS–will cost approximately $500 million in addition to the funds already targeted for Phase 1 of the Potable West Side system, as discussed above.[121] The SFPUC is not presently planning a programmatic City-wide expansion; it merely has developed a rough list of possible projects for various parts of the City that are not presently served by the HP AWSS (as well as other projects to reinforce or otherwise improve the HP AWSS system in those areas that are currently served by the HP AWSS).[122]

This roughly $500 million estimate is a huge amount of money, but as discussed in Section A above, the risk of incurring the costs from a major, inadequately-fought fire is far greater.

First and foremost is the risk to human life. In 1906, an estimated 3,000 people lost their lives, and 225,000 were left homeless. The City is obviously much better prepared today, with

---

[121] See "Candidate EFWS Projects" list dated May 8, 2019, attached as Appendix P. The actual total of projects related to system expansion is approximately $485 million, plus the $160 million for Phase 1 of the Westside project, for a total of $645 million. We have rounded the $485 million up to $500 million for the sake of simplicity and in recognition of the fact that these are all very preliminary high level estimates.

This Candidate EFWS Projects list is an internal SFPUC document: it is a list of potential project alternatives provided by the SFPUC staff to the EFWS Management Oversight Committee. The list contains potential projects that could be implemented in the future if approved by the EFWS Management Oversight Committee, if funding is made available, and if and when they go through the required environmental review. Due to the preliminary nature of the list, some of the estimated costs on this candidate project list are merely planning level estimates and would likely change if the SFPUC decided to move forward with a detailed design for a given project. Some of these projects, such as the Potable AWSS on the west side, are moving forward towards completion of design and technical studies and required environmental review based on management direction and the anticipated availability of funds. However, others are still simply candidate project alternatives that management may never proceed with.

This May 8 Candidate EFWS list also includes various proposals and potential projects to improve the seismic safety of the approximately 20 miles of HP AWSS pipes in the so-called infirm zones, as well other supply or proposed projects under consideration unrelated to any potential HP AWSS expansion. May 8, 2019 Candidate EFWS Project list attached as Appendix P; see CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 31 for a map of infirm zones.

Although the original AWSS system was designed to be seismically strong, and to survive an earthquake, it was designed shortly after the 1906 earthquake and installed by 1913. Most of the AWSS pipelines fared well during the Loma Prieta earthquake, although that was 60 miles away and not as big an earthquake as we will someday face. See, e.g., PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 9-12. Accordingly, no one knows for certain how the existing AWSS will fare in a major earthquake, especially in liquefaction areas or so-called infirm zones. The infirm zone projects, which are estimated to cost $135 million, involve installing new, backbone ERDIP pipe in each infirm zone, so that even if the existing AWSS pipe fails there will be at least one reliable major high-pressure pipeline in each area. Information provided by SFPUC; see also Appendix P.

[122] The recently approved 2020-2029 ten-year Capital Plan does not designate nearly enough money for EFWS to complete a City-wide expansion of the HP AWSS system. See http://onesanfrancisco.org/the-new-plan/overview

fire suppression systems, the existing HP AWSS, and modern building standards. Yet the 2017 North Bay fires and the 2018 Camp fire that destroyed the town of Paradise demonstrate how destructive and fast-moving fires can be under windy conditions. [123] In 1906, residents fled to the south and the west, to relatively uninhabited portions of the City that did not burn. Today, the entire City is densely populated and there would literally be no place for residents, especially our many senior citizens, to run to escape a fast-moving conflagration.

Second, in terms of property value, San Francisco has billions of dollars at risk. As discussed in Section A of this report, and in particular Table 1, a 2010 report prepared for the City estimated the range of losses due to fire following an earthquake could exceed $10 billion for a 7.9-magnitude event – in 2010 dollars. The damage estimates in Table 1 do not include business interruption losses, loss of tourism or loss of property tax revenues, all of which would undoubtedly be substantial.[124]

The substantial increase in San Francisco property values over the last decade undoubtedly increases the potential losses. In light of the dire consequences we face, the approximately $650 million price tag to expand the HP AWSS throughout the City (which includes Phase 1 of the proposed Potable AWSS on the west side), seems well worth the expenditure.

The Civil Grand Jury is not in a position to know whether each of the SFPUC's potential projects is essential, how the costs will change after detailed design work, further studies and environmental reviews, or whether more cost-efficient approaches exist. We are also not in a position to weigh the relative merits of the approximately $320 million in non-expansion-related projects on the SFPUC's Candidate EFWS Projects list.[125] But we do know that the current approach is taking too long. The SFPUC itself estimates that build-out of the AWSS "would take ~ 35 years using current funding rate assuming 5 year bond cycle."[126]

The most recent public timeline provided by the SFPUC is in CS-199, and is moot as the various projects have evolved over time. However, that timeline relies upon the issuance of

---

[123] As discussed above, wind is a major factor in fire spread. See, e.g., Kearns, F. and Moritz, M., *The Conversation* (November 16, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985; Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp. 8-9, 15, 18-19. The 1923 Tokyo earthquake and subsequent fires are probably the most devastating in peacetime, with substantially greater loss of life (an estimated 140,000 killed) than the 1906 earthquake. See Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019 at pp. 1-2, 19-23; see also Great Tokyo Earthquake of 1923, at http://factsanddetails.com/japan/cat26/sub160/item2226.html. Among the reasons for the devastation in Tokyo were winds of approximately 28 miles per hour at the time of the earthquake, with increasing wind throughout the day. *Id.*

[124] See CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 95-97.

[125] See May 8, 2019 Candidate EFWS Projects list, attached as Appendix P.

[126] SFPUC Emergency Firefighting Water System, Management Oversight Committee presentation dated March 4, 2019, at p. 32. The City is not committed to a five year bond cycle, so it could be even longer, although the increased level of funding in the proposed 2020 ESER bond indicates that things may be moving more rapidly.

ESER bonds every five to seven years, through and including a 2045 bond issuance, such that work would not be completed until 2049.[127]

Either way, this means that areas of our City, such as District 11, would not be as well protected as other areas, and would not have a HP AWSS in place if, as predicted by the USGS, a major earthquake hits the Bay Area before 2043.

Accordingly, the Civil Grand Jury recommends a major acceleration of these efforts, such that all areas of the City are protected by a seismically sound, multi-sourced, HP emergency water firefighting system within 15 years, i.e., by no later than 2034.

H. The Bottom Line: Act Fast, but Ensure Redundancy

Among the most important factors in designing an EFWS is redundancy. This is true whether the City chooses to extend the existing AWSS or to adopt a different approach. Regardless of the specific plan, there must be multiple, redundant sources of water such that if one source fails or a pipe breaks, firefighters have other means to obtain necessary water supplies.

In the Loma Prieta earthquake the Marina district was saved by the combination of the PWSS and a fireboat, or "the backup to the backup."[128] Unpredictable stuff happens, especially in a major earthquake, and redundancy is necessary.[129] This means not just looped pipe systems but also multiple sources of water. One of the great ironies of the 1906 earthquake is that San Francisco is surrounded by water yet it burned due to a lack of water.

The original HP AWSS was designed with both a redundant water supply and a gridded main system.[130] The system in the northeast quadrant of the City "seeks high post-earthquake

---

[127] Figure 5-1, *Preferred Alternative Planning Level Schedule,* from CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 71, and attached as Appendix R.

[128] See Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992); Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC; Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018).

[129] See, e.g., Metcalf & Eddy, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00 at p. 20; CS-199, at p. 11 ("Multiple redundancies in fire water supply systems are necessary."), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[130] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

reliability via multiple sources of supply."[131] Those sources include two above-ground storage tanks, a reservoir, two salt-water pumping stations, plus several fire boat manifolds if needed.[132]

Many citizens have called for installing a salt-water pump station or stations on the west side, arguing that the ocean provides an unlimited source of water.[133] A salt-water pump station north of Golden Gate Park would also provide geographic diversity of water sources, as the other proposed pumping stations and HP water sources are all south of Golden Gate Park. Dr. Scawthorn, the City's consultant, has asserted that a salt-water pump station on the west side "would be very beneficial."[134]

The Civil Grand Jury recognizes that this may raise environmental and other issues, and may or may not be necessary in light of the potential use of Lake Merced.[135] Nevertheless, the Civil Grand Jury strongly believes in having redundant and geographically diversified water sources, and developing a robust water source in the northwest quadrant of the City seems to us to be beneficial. Other areas of the City have added protection from the SFFD's four fireboats, which can be connected to the PWSS to provide an alternate water supply, as in Loma Prieta. Unfortunately, fireboats are not designed to work in the open water of the Pacific Ocean, and PWSS hose tenders cannot practically drive onto beaches to draft water from the ocean.[136] For these reasons, a salt-water pumping station on the west side seems particularly appropriate.

The need for further EFWS projects is underscored by two additional considerations, discussed more fully below. First, the reliability scores cited in the SFPUC's consultant's reports over-state how effective our current plans are likely to be upon completion. Second, these scores – and our safety – are predicated on being able to properly maintain and operate the existing AWSS assets, especially critical assets, so they are ready when needed.

---

131 Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 2.

132 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 7-8.

133 Pendergast, T, *Plan to Protect Neighborhood Abandoned*, Richmond Review (November 2017), https://sfrichmondreview.com/2017/11/02/plan-to-protect-neighborhoods-abandoned/ ; Fracassa, D, *SF Moves to Build Water System to Fight Fires for When the Worst Hits*, San Francisco Chronicle (February 11, 2018), https://www.sfchronicle.com/politics/article/SF-moves-to-build-water-system-to-fight-fires-12605847.php ; Doudiet, T., *Commentary–Sound the Fire Alarm!*, Richmond Review / Sunset Beacon (November 3, 2017), https://sfrichmondreview.com/2017/11/03/commentary-thomas-w-doudiet/ ; Wuerfel, N., *Commentary–SFPUC Misleads Public*, Richmond Review / Sunset Beacon (November 13, 2018), https://sfrichmondreview.com/2018/11/13/commentary-nancy-wuerfel-2/ .

134 Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, at p. 7.

135 Any plan to add a salt-water pump station would need to be responsive to concerns about reducing or even eliminating if possible any impacts on marine life.

136 Information provided by the SFFD.

I. Current FRA Reliability Scores Promote Overconfidence

The SFPUC's and the SFFD's goal is to provide a certain Level of Service (LOS) for emergency firefighting water supply throughout the City. In particular, the SFPUC has articulated the following LOS objective:

> AWSS will reliably provide water to supply the "probable fire demands" after a magnitude 7.8 San Andreas earthquake. Each FRA will have a minimum of 50% reliable water supply to meet probable fire demands. The Citywide average will be a minimum of 90% reliable water supply to meet probable fire demands.[137]

The Civil Grand Jury agrees with the goal that the City should be prepared to fight fires following a magnitude 7.8 San Andreas earthquake. However, we are concerned with the current measures of "reliability." As discussed below, the "reliability scores" being used by the City create a misleadingly optimistic impression and imply a false precision.

As explained in CS-199, "[i]n the context of this study, reliability is defined as the percentage of the water demand met by AWSS high-pressure system and other sources."[138] Put differently, the reliability score methodology "does not actually represent an estimate of reliability but is a ratio of the EFWS capacity and demand."[139]

The ratio of capacity and demand is a useful measure, but the scores being used are overly optimistic in that the estimated "demand" used is the *median* estimated demand.[140] By definition, half the time one would expect worse conditions and therefore greater demand for water to fight fires. Using a demand estimate that is by definition insufficient half the time is not truly preparing for a repeat of the 1906 earthquake.

The problem of using the median demand is exacerbated by the wide variation in the potential number of fires, fire size, and water demands.[141] As just one example, San Francisco was lucky that there was little to no wind during the Loma Prieta earthquake. Yet as any resident of our City knows, the City often experiences significant wind conditions.

Another problem with the reliability scores is that they ignore where in the FRA a fire is, as well as the size of each FRA. For example, the southeastern portion of the City has several geographically large FRAs.[142] Although water may be able get to the northern part of a particular FRA, the southern part of that FRA may not be as well protected. In addition, the

---

137 2018 Westside Options Analysis, at p. 7, https://www.sfwater.org/modules/showdocument.aspx?documentid=117400 ; CS-199, at p. 102, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 .

138 CS-199, at p. ix, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

139 Scawthorn 2018 memo, at p. 6, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

140 *Id.*, at p. 5.

141 *Id.*, at p. 5.

142 See map of FRAs, attached as Appendix J.

demand represents the water supply need for an entire FRA, and the scores assume that the SFFD "would utilize the Portable Water Supply System (PWSS) or engine relays to distribute the water supply within the FRA to the actual ignition locations."[143] This is an unrealistic assumption, given the City's current inventory of only five old PWSS hose tenders, and the likely demand on fire engines in a major earthquake with a multitude of fires.

The SFPUC is in the process of analyzing potential EFWS demands on a more detailed level, and has shared some of the preliminary results with the Civil Grand Jury. The Civil Grand Jury supports this approach and recommends that the SFPUC continue its efforts to make a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA.

J. Maintenance and Training Issues

1. Maintenance Issues

AWSS assets must be well maintained in order to be operational during an emergency. A 2014 study prepared for the SFPUC by its outside consultants AECOM/AGS, a Joint Venture found "maintenance deficiencies" because routine maintenance plans had not been established for all AWSS assets. Instead, maintenance was being performed on an "as needed" basis.[144]

During our investigation, the Civil Grand Jury learned that the SFPUC has not developed a number of the routine maintenance plans recommended in the 2014 report.[145] The SFPUC assured us that it has done a good job at maintaining AWSS, and disagrees with some of the recommendations in that 2014 report. Nevertheless, the SFPUC has yet to develop routine maintenance plans for some important AWSS assets.

As an example, the report recommended the SFPUC adopt plans to regularly exercise all AWSS system valves.[146] In response, the SFPUC expressed a "goal" to exercise critical valves every two years.[147] It has defined "critical valves" to include only 66 out of the approximately 1,685 valves in the HP AWSS system.[148] SFPUC personnel acknowledge that its current approach is not a "best practice," and that valves should likely be exercised on a regular basis. SFPUC personnel also acknowledge that its definition of what constitutes a "critical" valve requiring more frequent testing is probably too narrow.[149]

---

143 2018 Westside Options Analysis, at p. 37, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

144 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 15-16, 24-26.

145 Information provided by SFPUC.

146 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 25.

147 Information provided by SFPUC.

148 Ibid.

149 Interviews with SFPUC personnel.

In another instance, the 2014 report recommended that all suction connections be cleaned on a regular basis.[150] The SFPUC noted that suction connections were cleaned in 2014, but that the agency had not adopted a routine maintenance plan.[151]

Now that the SFPUC has had time to focus on the condition of the AWSS, the Civil Grand Jury recommends that it utilize "best practices" for the maintenance of AWSS assets, including valves and suction connections, and that the SFPUC, with the help of the SFFD, redefine which valves in the system are "critical," and, therefore, require more attention and priority in its maintenance plans.

2. Coordinated Training and Drills

Another recommendation in CS-199, the 2014 report prepared for the SFPUC by its outside consultant AECOM/AGS, a Joint Venture, was that the SFPUC "prepare an emergency response program and conduct training exercise [sic]."[152] The report also recommended that SFPUC staff be trained on the AWSS system, including "communications, operational strategies," and "emergency response requirements."[153] Both of these recommendations were given "high" priority, and assessed to entail "low" ongoing cost.[154]

In 2015, the SFFD and the SFPUC entered into a Memorandum of Understanding ("MOU") regarding the operation and maintenance of water-supply systems related to fire suppression.[155] In Section C, entitled "Coordinated Emergency Operations Between the SFWD and SFFD", the MOU requires that "All members of the SFWD ... must be trained in the AWSS and the AWSS SCADA system along with the SFFD Water Supply manual."[156] The MOU also specifies that "[t]he SFFD and the SFWD will collaborate for annual training on system operations and appropriate shut-down procedures during and after firefighting operations."[157] The MOU, therefore, requires the SFPUC and the SFFD to coordinate to train all SFWD personnel on the

---

150 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 15-16, 24-26, 88, 135. There are approximately35 suction connections along the bay that allow engine pumpers to draw by suction from the bay, and a suction line with low-pressure hydrants along Fulton St. that draws from lakes in Golden Gate Park. Some of these suction connections are located on the bottom of the Bay and can be filled with silt or marine organisms that would interfere with water pumping.

151 Interviews with SFPUC personnel.

152 CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. x, 88.

153 Ibid.

154 Ibid.

155 Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.

156 *Id.*, at Section C.1.

157 *Id.*, at Section C.3.

AWSS system and on other available water supply sources to fight fires in emergencies. It also requires coordinated, *annual* training on emergency operation of the system.

In 2017, the SFPUC updated its Emergency Response Plan.[158] A review of the Plan, however, offers little detail on the type of exercise conducted or how often exercises might be conducted in the future.[159] Similarly, although CS-199 identified the need for emergency training and a training exercise, CS-199 did not provide details as to the scope or frequency of any training exercises.

In the past several years the SFFD and SFPUC have taken advantage of many opportunities for joint training concomitant with their joint operation and maintenance of AWSS assets. For example, the two agencies test Pump Stations 1 and 2, on a monthly basis. The agencies also meet after greater-alarm fires to discuss coordination, and how to improve operations in the field. In addition, the SFFD and SFPUC have, on occasion, conducted joint emergency trainings involving earthquake disaster scenarios. In 2018, for example, they engaged in a "tabletop exercise" where high-level staff members were asked to respond to a hypothetical earthquake scenario to test their understanding of the emergency command structure.

The SFPUC anticipates that it will repeat this joint tabletop exercise at least every other year, and that it will conduct larger-scale simulations of post-earthquake emergency response procedures with the SFFD within the next two years. There is no formal document, however, outlining specific joint exercises or drills to be conducted by the two agencies.

In the 1989 Loma Prieta earthquake, human error was cited by some as a reason why AWSS was not available to fight fires in the Marina.[160] A 2011 survey of California fire and water agencies concluded, generally speaking, that "[f]ire and water department liaison is not very good" and that "[e]mergency firefighting water supply is not a focus."[161] Moreover, the report found that fire departments are not "regularly drilled for the very difficult task of moving water from the alternative water sources to the fire scene."[162]

The Civil Grand Jury believes that the City would be well served if the SFPUC and SFFD worked together to design and implement annual "hands-on" drills to make certain that their staff is prepared to use all available resources to fight fires after an earthquake. Accordingly, the Civil Grand Jury recommends that the MOU between the SFPUC and the SFFD be amended to include a more detailed roadmap for emergency response exercises to be held, City-wide,

---

[158] Information provided by SFPUC.

[159] City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

[160] See, e.g., Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992).

[161] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 75. By contrast, both the SFPUC and the SFFD have indicated that they currently enjoy excellent communication.

[162] *Id.*

annually. In addition to tabletop scenarios, these exercises should include hands-on field testing in the operation of AWSS assets and PWSS units.

CONCLUSION

Over one hundred years ago, our City was destroyed by fire following an earthquake. Luckily, our predecessors learned from this catastrophe. They aggressively undertook to design, fund, and quickly build a supplemental emergency water supply system that provided firefighters with multiple options if one or more water sources were compromised – "belt and suspenders." They gave us an excellent emergency water system to protect our wonderful, seismically vulnerable City.

We have, however, long outgrown the protective reach of the system we inherited. Now it is our turn to aggressively implement measures to extend protections to reach all San Francisco neighborhoods. The time to act is now, before it is too late.

FINDINGS

F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.

F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.

F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.

F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.

F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.

F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.

F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.

F8. Redundancy is an important feature of an emergency firefighting water system.

F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.

F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.

F11. The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.

F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.

F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.

RECOMMENDATIONS

R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.

R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.

R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.

R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.

R6. The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.

R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.

R9. By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.

R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the Civil Grand Jury requests responses as follows:

From the following City and County agencies and departments within 60 days:

- Office of the Mayor
  - Findings 4, 5, 6, and 11
  - Recommendations 1, 2, 4, and 8
- General Manager, San Francisco Public Utilities Commission
  - Findings 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13
  - Recommendations 1, 2, 6, 7, 9, and 10
- Chief, San Francisco Fire Department
  - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 13
  - Recommendations 1, 2, 4, 5, 6, 7, and 10
- Office of the City Administrator
  - Findings 6 and 11
  - Recommendations 1, 2 and 8
- Chief Resilience Officer, Office of the City Administrator
  - Findings 6 and 11
  - Recommendations 1, 2 and 8
- Director, San Francisco Department of the Environment
  - Recommendation 6
- Budget and Legislative Analyst Office, Board of Supervisors
  - Findings 6 and 11
  - Recommendation 3

From the Board of Supervisors and other governing bodies within 90 days:

- Board of Supervisors
  - Findings 4, 5, 6 and 11
  - Recommendations 1, 2, 3, 4, 6, 7, and 8
- San Francisco Public Utilities Commission
  - Findings 2, 4, 5, 6, 8, 9, 10, 11, and 12
  - Recommendations 1, 2, 6, 7, 9, and 10
- San Francisco Fire Commission
  - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11
  - Recommendations 1, 2, 4, 5, 6, 9 and 10

GLOSSARY AND TABLE OF ACRONYMS AND ABBREVIATIONS

ATC	Applied Technology Council. A non-profit corporation whose mission is to develop and promote state-of-the-art, user-friendly engineering resources and applications for use in mitigating the effects of natural and other hazards on the built environment, and which prepared reports in 2010 for the City under the CAPSS Project.
AWSS	Auxiliary Water Supply System. An independent emergency firefighting system built after the 1906 earthquake. The AWSS at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations. The AWSS HP pipelines can supply water at pressures up to 300 psi via hydrants with black, red or blue tops, depending upon location.
CAPSS	Community Action Plan for Seismic Safety. According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts.
CCSF	City and County of San Francisco
CDD	City Distribution Division. The division of the SFPUC responsible for maintenance of both the MWSS and the AWSS.
DWSS	Domestic Water Supply System, also referred to as the Municipal Water Supply System, MWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS (DWSS) is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
ERDIP	Earthquake Resistant Ductile Iron Pipe. A modern type of pipe that is believed to be earthquake resistant and that has been subjected to several major earthquakes in Japan without any observed failures.
EFWS	Emergency Firefighting Water System. All emergency sources of water and the means for delivering them. Includes HP AWSS pipelines, cisterns, PWSS and fireboats.
ESER	Earthquake Safety and Emergency Response. ESER bonds are generally issued every five to seven years to address to fund repairs and improvements to infrastructure that allow the City to respond more quickly and effectively to a major earthquake or other disaster.

FRA	Fire Response Area. The SFFD divides the City into 46 areas for initial alarm response, referred to as Fire Response Areas or FRAs.
HP	High-pressure
LOS	Level of Service
MOU	A Memorandum of Understanding between the SFPUC and the SFFD Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.
MWSS	Municipal Water Supply System, also referred to as the Domestic Water Supply System, DWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
PEER	Pacific Earthquake Engineering Research Center
PSI	Pounds per square inch
PWSS	Portable Water Supply System. A mobile above-ground large (five-inch) diameter hose system transported on trucks (hose tenders). A hose tender truck can carry approximately 5000 feet of five-inch hose. A more thorough description is provided at pages 23-26. The PWSS is not to be confused with the flexible water supply system, an idea for 12-inch diameter hoses that was abandoned as impractical.
SCADA	Supervisory Control and Data Acquisition. A computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
SFDPW	San Francisco Department of Public Works
SFFC	San Francisco Fire Commission
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
USGS	United States Geological Survey
WSIP	Water System Improvement Program. The WSIP is a $4.8 billion dollar, multi-year program to upgrade the SFPUC's regional and local water systems. The WSIP, which is over 96% complete, is one of the largest water infrastructure

programs in the nation and the largest infrastructure program ever undertaken by the City.

APPENDICES

A. Table of Findings and Recommendations
B. Table of Findings with Required Responses
C. Table of Recommendations with Required Responses
D. List of Reports Specifically Focusing on the City's AWSS or PWSS
E. List of Additional Reports Reviewed
F. USGS, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf
G. USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf
H. Map of Existing EFWS, with HP AWSS, Cisterns and other Assets
I. Map of Existing HP AWSS system
J. Map of SFFD Fire Response Areas
K. Abstract (page 2) from Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf
L. Analysis by the Ballot Simplification Committee of 1986 Proposition A.
M. San Francisco Fire Commission Resolution 2010-01, dated January 14, 2010, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf
N. SFPUC 2017 FAQ, https://sfwater.org/modules/showdocument.aspx?documentid=11507 printed March 6, 2019
O. SFPUC EFWS 2010 and 2014 ESER bond project status as of February 26, 2019
P. SFPUC Candidate EFWS Project list dated May 8, 2019
Q. Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990
R. Figure 5-1, *Preferred Alternative Planning Schedule*, from CS-199, at p. 71, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

APPENDIX A
TABLE OF FINDINGS AND RECOMMENDATIONS

Findings	Recommendations
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco. F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake. F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake. F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake. F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake. R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034. R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

Findings	Recommendations
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced seismically safe emergency water supply can be developed in those areas.	R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.
F8. Redundancy is an important feature of an emergency firefighting water system. F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

Findings	Recommendations
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

APPENDIX B
TABLE OF FINDINGS WITH REQUIRED RESPONSES

Findings	Required Responses
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	• Chief, San Francisco Fire Department • San Francisco Fire Commission • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Chief, San Francisco Fire Department • San Francisco Fire Commission
F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	• Chief, San Francisco Fire Department • San Francisco Fire Commission
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F8. Redundancy is an important feature of an emergency firefighting water system.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	• General Manager, San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department

APPENDIX C
TABLE OF RECOMMENDATIONS WITH REQUIRED RESPONSES

Recommendations	Required Responses
R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short-term and the long-term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	• Board of Supervisors • Budget and Legislative Analyst Office, Board of Supervisors

Recommendations	Required Responses
R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	• Office of the Mayor • Board of Supervisors • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Director, San Francisco Department of the Environment
R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above the median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department
R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034	• Office of the Mayor • Board of Supervisors • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator

Recommendations	Required Responses
R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

APPENDIX D
List of Reports Specifically Focusing On the City's AWSS or PWSS

2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf

AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report) (February 2014) ("CS-199"), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, prepared for SFPUC (February 2014), https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907

AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015) ("CS-229"), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246

AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report (January 5, 2018) ("2018 Westside Options Analysis"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found online at http://www.sfearthquakesafety.org/eser-reports.html

Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7

Metcalf & Eddy / AECOM, Auxiliary Water Supply System (AWSS) Study, prepared for Capital Planning Committee, City and County of San Francisco (2009) ("Metcalf & Eddy"), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00

San Francisco Department of Public Works, Auxiliary Water Supply System (AWSS) Pipeline Assessment, Earthquake Safety and Emergency Response Bond 2010, prepared for SFPUC (May 11, 2017), https://sfpuc.sharefile.com/share/view/684778cd4b46406e

Scawthorn, C., January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis", (Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC

APPENDIX E
List of Additional Reports Reviewed

Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010)("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf

Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety, prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project (2010), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517

Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018)

City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019

Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf

Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf

Kearns, F. and Moritz, M., How fierce fall and winter winds help fuel California fires, *The Conversation* (16 November, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985

Li, W., Wang, D., and Zhao, K., Research on Urban Post-earthquake Fire, presented at Sixth China-Japan-U.S. Trilateral Symposium on Lifeline Earthquake Engineering (2013) https://ascelibrary.org/doi/10.1061/9780784413234.008

Moritz, M., *California Needs To Rethink Urban Fire Risk, Starting with Where It Builds Houses*, in The Conversation (December 13, 2017), https://theconversation.com/california-needs-to-rethink-urban-fire-risk-starting-with-where-it-builds-houses-88825

O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996)

San Francisco Fire Department Emergency Operations Plan

San Francisco Fire Department Water Supplies Manual (2008), http://ufsw.org/pdfs/water_supplies_manual.pdf

Scawthorn, C., Coordinated Planning and Preparedness for Fire Following Major Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2013), https://ssc.ca.gov/forms_pubs/webpeer-2013-23-scawthorn.pdf

Scawthorn, C., Water Supply In Regards to Fire Following Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf

Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf

Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf or for a copy, click here.

Scawthorn, C., Fire Following Earthquake Aspects of the Southern San Andreas Fault M_W 7.8 Earthquake Scenario. *Earthquake Spectra* 27 (2), 419-441 (2011), http://www.sparisk.com/pubs/Scawthorn-2011-ShakeOut-FFE.pdf

Scawthorn, C., *Fire Following Earthquake, Supplemental Study for the ShakeOut Scenario.* The ShakeOut Scenario: U.S. Geological Survey Open File Report 2008-1150, California Geological Survey Preliminary Report 2, version 1.0, U.S. Geological Survey Circular 1324, California Geological Survey Special Report 207 version 1.0. U. S. Geological Survey and California Geological Survey, Pasadena (2008), Scawthorn-2008-ShakeOut-FFE

Scawthorn, C., Fire Following the M_w 7.0 HayWired Earthquake Scenario, in Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Engineering Implications*. Scientific Investigations Report 2017–5013–I–Q. Reston, VA: United States Geological Survey, ch. P, pp. 367-400 (2018), at https://doi.org/10.3133/sir20175013 and www.sparisk.com/pubs/HayWired-2018-vol2.pdf

Scawthorn, C., O'Rourke, T. D. & Blackburn, F. T., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply.* Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf.

Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

U.S. Geological Survey, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf

U.S. Geological Survey, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf

Appendix F

USGS science for a changing world · SCEC AN NSF+USGS CENTER · CGS CALIFORNIA GEOLOGICAL SURVEY · CEA CALIFORNIA EARTHQUAKE AUTHORITY THE STRENGTH TO REBUILD

UCERF3: A New Earthquake Forecast for California's Complex Fault System

With innovations, fresh data, and lessons learned from recent earthquakes, scientists have developed a new earthquake forecast model for California, a region under constant threat from potentially damaging events. The new model, referred to as the third Uniform California Earthquake Rupture Forecast, or "UCERF3" (http://www.WGCEP.org/UCERF3), provides authoritative estimates of the magnitude, location, and likelihood of earthquake fault rupture throughout the state. Overall the results confirm previous findings, but with some significant changes because of model improvements. For example, compared to the previous forecast (UCERF2), the likelihood of moderate-sized earthquakes (magnitude 6.5 to 7.5) is lower, whereas that of larger events is higher. This is because of the inclusion of multifault ruptures, where earthquakes are no longer confined to separate, individual faults, but can occasionally rupture multiple faults simultaneously. The public-safety implications of this and other model improvements depend on several factors, including site location and type of structure (for example, family dwelling compared to a long-span bridge). Building codes, earthquake insurance products, emergency plans, and other risk-mitigation efforts will be updated accordingly. This model also serves as a reminder that damaging earthquakes are inevitable for California. Fortunately, there are many simple steps residents can take to protect lives and property.

What is UCERF3?

California is sandwiched between the Pacific and North American tectonic plates, with the former migrating northwest about two inches per year compared to the latter. The plate boundary is far from smooth, reflecting more of a fragmented zone locked in a tectonic battle over which areas will give way, producing some of the steepest mountain ranges in the world. The sliding between plates is also not steady, but rather plays out in fits and starts with periods of rest interrupted by sudden slip along cracks in the Earth. These "fault ruptures" in turn cause the ground to shake, much like the ripples that radiate from a pebble tossed in a pond, and it is this shaking that causes the most damage in earthquakes.

Two kinds of scientific models are used to help safeguard against earthquake losses: an Earthquake Rupture Forecast, which tells us where and when the Earth might slip along the state's many faults, and a Ground Motion Prediction model, which estimates the subsequent shaking given one of the fault ruptures. UCERF3 is the first type of model, representing the latest earthquake-rupture forecast for California. It was developed and reviewed by dozens of leading scientific experts from the fields of seismology, geology, geodesy, paleoseismology, earthquake physics, and earthquake engineering. As such, it represents the best available science with respect to authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes throughout the state (further background on these models, especially with respect to ingredients, can be found in U.S. Geological Survey Fact Sheet 2008–3027, http://pubs.usgs.gov/fs/2008/3027/).

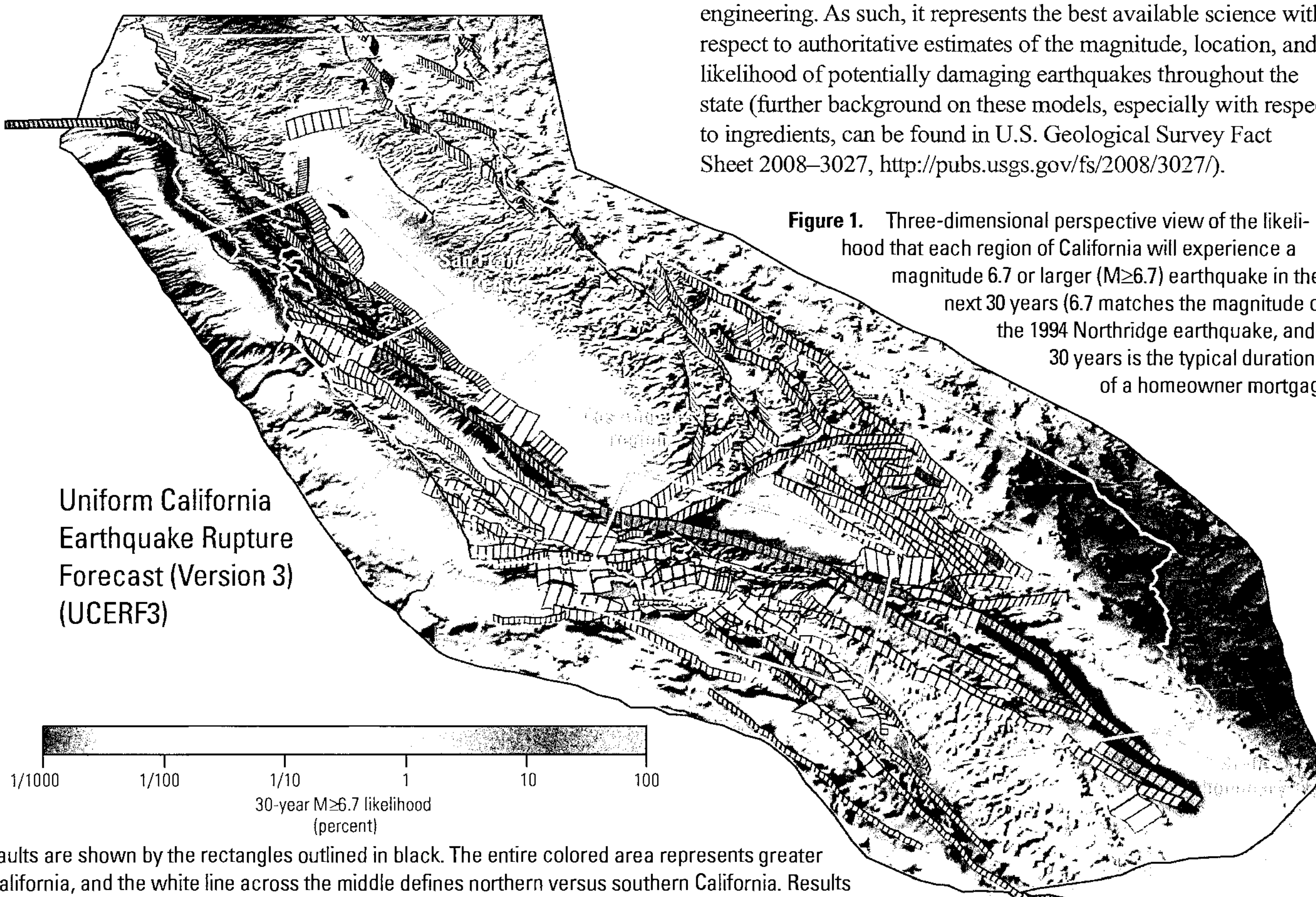


Figure 1. Three-dimensional perspective view of the likelihood that each region of California will experience a magnitude 6.7 or larger (M≥6.7) earthquake in the next 30 years (6.7 matches the magnitude of the 1994 Northridge earthquake, and 30 years is the typical duration of a homeowner mortgage).

Faults are shown by the rectangles outlined in black. The entire colored area represents greater California, and the white line across the middle defines northern versus southern California. Results do not include earthquakes on the Cascadia Subduction Zone, a 750-mile offshore fault that extends about 150 miles into California from Oregon and Washington to the north.

U.S. Department of the Interior
U.S. Geological Survey

Printed on recycled paper

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20153009

Fact Sheet 2015–3009
March 2015

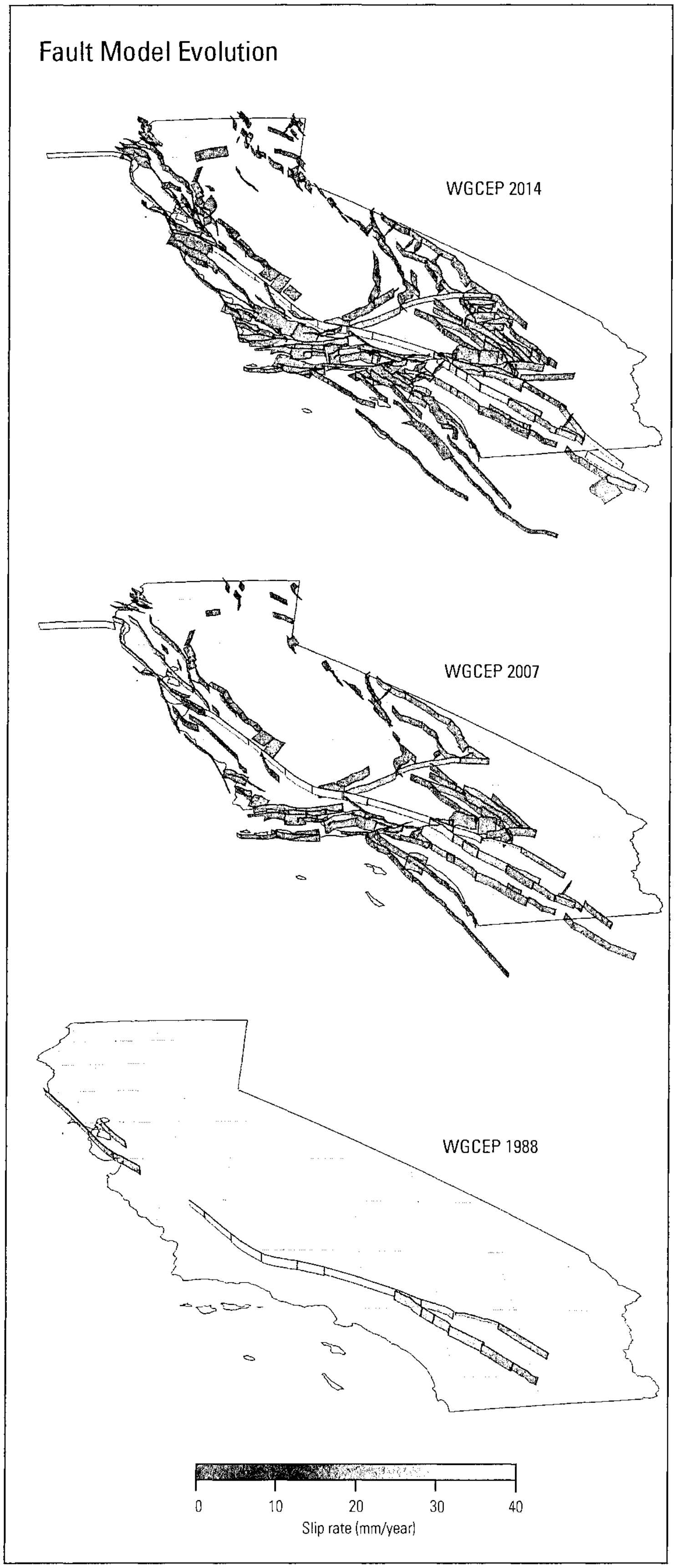


Figure 2. Changes with time of the inventory of faults used in California earthquake forecast models (WGCEP, Working Group on California Earthquake Probabilities).

Why a New Earthquake Forecast Model?

All scientific models, including earthquake rupture forecasts, are an approximation of the physical system they represent, in the same way that "the map is not the actual territory" (Korzbski, 1931). UCERF3 represents the latest model from the Working Group on California Earthquake Probabilities (WGCEP) (WGCEP, 2014), which also released forecasts in 1988, 1990, 1995, 2003, and 2007. This historical progression of models reflects increasingly accurate, detailed, and sophisticated representations of a particularly complex natural system.

A puzzling feature of previous models has been a forecasted rate of moderate-sized earthquakes (between magnitude 6.5 and 7.0) that is up to a factor of two higher than that observed historically. The first discovery of this discrepancy, by the 1995 WGCEP, was particularly disturbing in that one such event, the magnitude 6.7 1994 Northridge earthquake, had just surprised many as the costliest earthquake in U.S. history. In fact, the prospect of such events becoming more frequent contributed to an ensuing homeowner-insurance-availability crisis, as most insurance providers opted to pull out of the market altogether, rather than comply with a state law requiring they offer an earthquake option with each policy. This insurance availability crisis was ultimately solved in 1996 with the legislative creation of the California Earthquake Authority (http://www.earthquakeauthority.com), which has since become the largest earthquake insurance provider in the state. However, the discrepancy between the forecast rate and the observed rate at moderate magnitudes has remained through the most recent previous study (WGCEP, 2007), and scientists have hotly debated whether this is real or a result of some model limitation.

Recent earthquakes have fortunately provided clues. For example, the Northridge earthquake occurred on a previously unrecognized fault, which motivated scientists to search for other faults and quantify those that might be capable of producing damaging earthquakes. The effort has paid off. Whereas the 1988 WGCEP considered only 16 different faults, albeit the main ones, by the time of the WGCEP 2007 effort there were about 200. With UCERF3, there are now more than 350 fault sections in the model, thanks in part to using space-based geodesy where geologic data are limited. This historical progression is shown in the fault model evolution figure at left.

Another clue with respect to the moderate-magnitude rate discrepancy is that many recent earthquakes have plowed past previously inferred fault-rupture boundaries. That is, past models have generally assumed that earthquakes are either confined to separate faults, or that long faults like the San Andreas can be divided into different segments that only rupture separately. However, all three of the most-recent, largest earthquakes in California ruptured right past such boundaries, jumping from one fault to another as multifault ruptures. These were the 1992 magnitude 7.3 Landers, the 1999 magnitude 7.2 Hector Mine, and the 2010 magnitude 7.2 El Mayor–Cucapah earthquakes. The 2011 magnitude 9.0 Tohoku, Japan earthquake also violated previously defined fault-segment boundaries, resulting in a much larger fault-rupture area and magnitude than expected, and contributing to the deadly tsunami and Fukushima nuclear disaster.

Given these observations, the possibility of multifault ruptures clearly needed to be considered in our new model. In fact, as the inventory of California faults has grown over the years, it

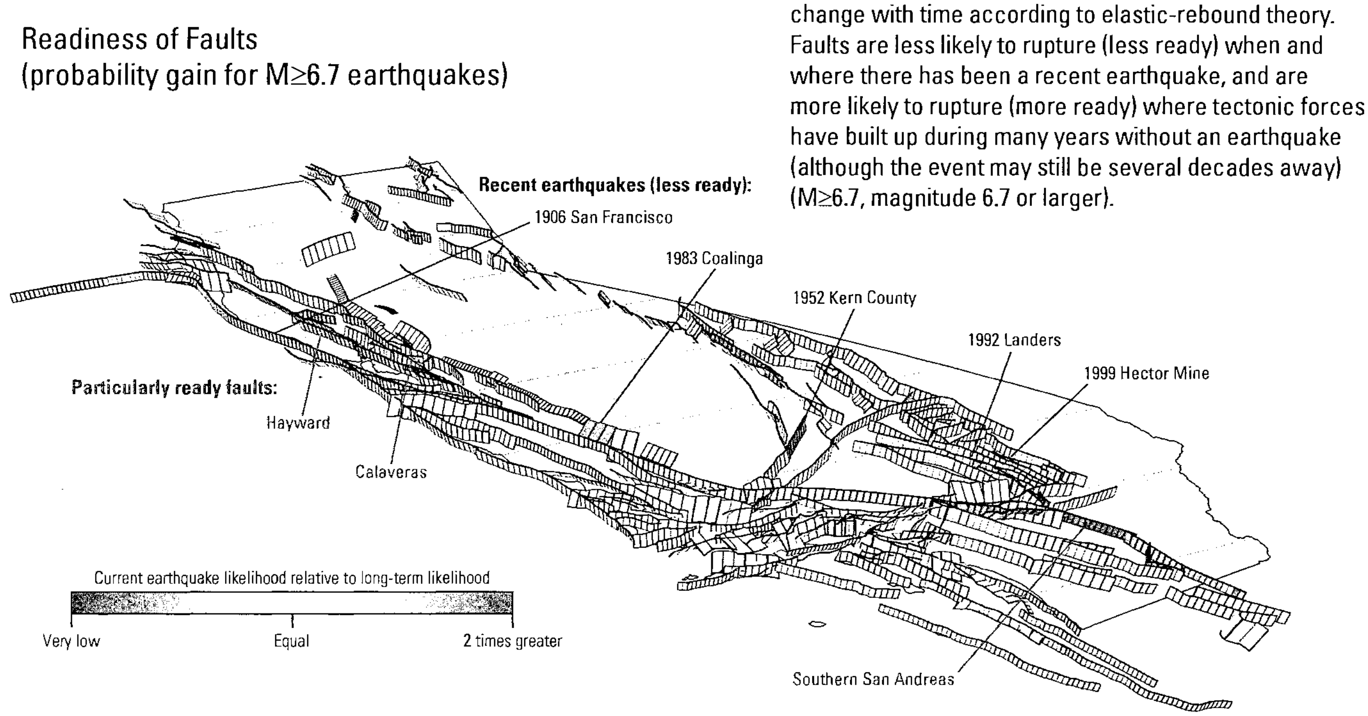


Figure 3. California earthquake likelihood in UCERF3 incorporates the concept that earthquake probabilities change with time according to elastic-rebound theory. Faults are less likely to rupture (less ready) when and where there has been a recent earthquake, and are more likely to rupture (more ready) where tectonic forces have built up during many years without an earthquake (although the event may still be several decades away) (M≥6.7, magnitude 6.7 or larger).

has become increasingly apparent that we are not dealing with a few well-separate faults, but with a vast interconnected fault system. In fact, it has become difficult to identify where some faults end and others begin, implying many more opportunities for multifault ruptures. As a consequence, UCERF3 now considers more than 250,000 different fault-based earthquakes, including multifault ruptures, whereas UCERF2 had about 10,000, and previous models had far fewer. Because we still lack a complete inventory of faults, UCERF3 (and UCERF2 before it) also includes the possibility of earthquakes on unrecognized faults elsewhere in the region.

Solving for the rate of all possible ruptures in the interconnected fault system represented a significant challenge. The UCERF3 methodological breakthrough, referred to as the "grand inversion," allowed us to not only solve for the rate of each earthquake rupture, but to also draw upon a broader range of observations in doing so. For example, the previous rate discrepancy at moderate-magnitudes was turned into part of the solution. That is, because the total plate-tectonic deformation is generally well known, any increase in the rate of larger, multifault ruptures must come with a consequent reduction in rates at lower magnitudes. The grand inversion manages the overall plate-tectonic, fault-system budget mathematically, adding whatever multifault ruptures are needed to eliminate the rate discrepancy at moderate magnitudes. So, not only does UCERF3 include the types of multifault ruptures seen in nature, but doing so has also eliminated the overprediction of moderate-sized events, implying the latter was simply a manifestation of the isolation and segmentation of faults in the previous models.

UCERF3 also includes the notion of fault "readiness," where earthquake likelihoods go down on faults that have recently ruptured, and build back up with time as tectonic stresses reaccumulate. Although this concept, known formally as Reid's elastic rebound theory (Reid, 1911), has been around for more than a century, applying it in a model that includes multifault ruptures also proved challenging. A new methodology was therefore developed, which also relaxes the requirement that the date-of-last event be known where applied. That is, we may not know when the most recent event occurred on many California faults, but we do know that it had to have been prior to 1875 (the year when reliable recordkeeping began). Being able to account for this "historic open interval" for events that precede 1875 allowed us to quantify fault readiness throughout the entire fault system (fig. 3), rather than being limited to only a subset of faults as in previous studies.

There are many uncertainties in both the data and scientific theories that go into UCERF3, and alternative values for each element can lead to a different forecast. Consequently, UCERF3 is not a single model, but rather a collection of 5,760 different viable models. The results presented in the next section represent an average of these forecasts. Calculating grand-inversion results for all the models required the use of super computers, as they would have taken more than 8 years on a single desktop computer.

What Are the Results, and How Do They Differ from Previous Estimates?

UCERF3 results for various regions and faults of interest are shown in the figures and tables here. How have expected earthquake rates changed from the previous model? Overall, the results confirm earlier findings (California is earthquake country), but with some important refinements in certain areas. Considering the entire region, the average time between magnitude 6.7 and larger earthquakes has gone from 1 every 4.8 years in UCERF2, to 1 about every 6.3 years in UCERF3, representing a 30 percent decrease in the new forecasted

Table 1. Average time between earthquakes in the various regions together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014). Values listed in parentheses indicate the factor by which the rates and likelihoods have increased, or decreased, since the previous model (UCERF2). "Readiness" indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes (see text). These values include aftershocks. It is important to note that actual repeat times will exhibit a high degree of variability, and will almost never exactly equal the average listed here.

Greater California region

Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.12	(0.7)	100%	(1.0)	1.0
6	1.2	(0.9)	100%	(1.0)	1.0
6.7	6.3	(1.3)	>99%	(1.0)	1.0
7	13	(1.3)	93%	(1.0)	1.0
7.5	52	(1.0)	48%	(1.0)	1.1
8	494	(0.8)	7%	(1.5)	1.2

Southern California region

Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.3	(0.9)	100%	(1.0)	1.0
6.7	12	(1.5)	93%	(1.0)	1.0
7	25	(1.4)	75%	(0.9)	1.1
7.5	87	(1.2)	36%	(0.9)	1.2
8	522	(0.4)	7%	(2.5)	1.3

Northern California region

Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.4	(0.9)	100%	(1.0)	1.0
6.7	12	(1.2)	95%	(1.0)	1.0
7	25	(1.2)	76%	(1.0)	1.1
7.5	92	(0.9)	28%	(1.1)	1.0
8	645	(0.8)	5%	(1.4)	1.1

San Francisco region

Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.3	(0.7)	100%	(1.0)	1.0
6	8.9	(1.0)	98%	(1.0)	1.0
6.7	29	(1.1)	72%	(1.1)	1.1
7	48	(0.9)	51%	(1.3)	1.1
7.5	124	(0.7)	20%	(1.6)	0.9
8	825	(0.7)	4%	(1.9)	1.0

Los Angeles region

Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.4	(0.6)	100%	(1.0)	1.0
6	10	(1.1)	96%	(1.0)	1.0
6.7	40	(2.1)	60%	(0.8)	1.1
7	61	(2.0)	46%	(0.7)	1.2
7.5	109	(1.3)	31%	(0.9)	1.3
8	532	(0.4)	7%	(2.5)	1.3

rate (and note that most of these events occur in remote areas of the state). For magnitude 8 and larger, on the other hand, the rate has increased by 20 percent in UCERF3, with an expected repeat time of 494 years for UCERF3, down from 1 every 617 years in UCERF2. These changes are a direct and expected manifestation of including multifault ruptures in UCERF3. A more careful analysis of historical seismicity has also produced an increased rate for magnitude 5 and greater earthquakes, going from about 5.8 per year in UCERF2 to 8.3 per year in UCERF3. All of these trends are similar to those seen in various subregions of the state, with differences being slightly more dramatic for the Los Angeles area because that region has a large number of faults that can now host multifault ruptures.

Results are also expressed in terms of the likelihood of experiencing one or more earthquakes in the next 30 years, the duration of a typical home mortgage, and these values also take fault readiness into consideration (how long it has been since the most recent event). As in UCERF2, the likelihood for magnitude 6.7 and larger earthquakes somewhere in the entire region remains near certainty (greater than 99 percent). The likelihood is 7 percent for magnitude 8 and greater, a 50 percent increase over UCERF2, resulting from both the inclusion of multifault ruptures and the particular readiness of some large faults.

One particularly ready fault is the Southern San Andreas, which contributes to its continued status of being the most likely to host a large earthquake. Specifically, it has a 19 percent chance of having one or more events larger than magnitude 6.7 in the next 30 years near Mojave, Calif. The comparably low values for the Northern San Andreas, such as 6.4 percent near San Francisco, are partly because of the relatively recent 1906 earthquake on that fault. In fact, probabilities on two other Bay Area faults, the Hayward–Rodgers Creek and the Calaveras, currently rival or exceed those on the Northern San Andreas, in part because they are both relatively ready.

Compared to the previous model, UCERF2, the San Jacinto fault has a three-fold decrease in the likelihood of magnitude 6.7 or larger earthquakes. Much of this decrease is because of the inclusion of more multifault ruptures, as indicated by the factor of 57 increase in the likelihood of magnitude 8 and larger earthquakes. In other words, the fault has traded some moderate-sized events for rare larger ones.

The Calveras fault, on the other hand, has a three-fold increase in the likelihood of magnitude 6.7 or larger earthquakes. In UCERF2 most Calaveras events were well below magnitude 6.7, so the inclusion of multifault ruptures in UCERF3 has increased the frequency of earthquakes above magnitude 6.7.

We have only touched on a few of the more important changes between UCERF2 and UCERF3, and have highlighted only some of the influential factors. Many more are currently understood, and scientists will be further analyzing results and testing assumptions for years to come.

So what do these changes imply with respect to seismic hazard, the likelihood of ground shaking, as well as for seismic risk, the threat to the built environment with respect to fatalities and economic losses? The answer turns out to be entirely dependent on what you are concerned about. For example, increasing the likelihood of large multifault earthquakes, which consequently reduces the likelihood of moderate-sized events, may increase the risk to tall buildings or large bridges, but actually lower the risk to residential homes.

As a consequence, it is difficult to make generalizations about the hazard or risk implications of UCERF3 without first specifying both asset types and their locations. Conclusions will vary depending on whether you are designing a single family dwelling in Sacramento, retrofitting the San Francisco–Oakland Bay Bridge, considering the location of a nuclear power plant, laying pipeline across the San Andreas Fault, or considering aggregate losses over a large insurance portfolio. The practical implications will need to be considered on a case-by-case basis.

What Next?

UCERF3 can now be used to evaluate seismic hazard and risk in California. In fact, it has already been used for the 2014 update of the U.S. Geological Survey National Seismic Hazard Maps (http://earthquake.usgs.gov/hazards/), which in turn are used in building codes. The California Earthquake Authority, which is required by law to use the best available science, will use UCERF3 to evaluate insurance premiums charged to customers, as well as their own level of reinsurance. UCERF3 will be used in many other risk mitigation

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

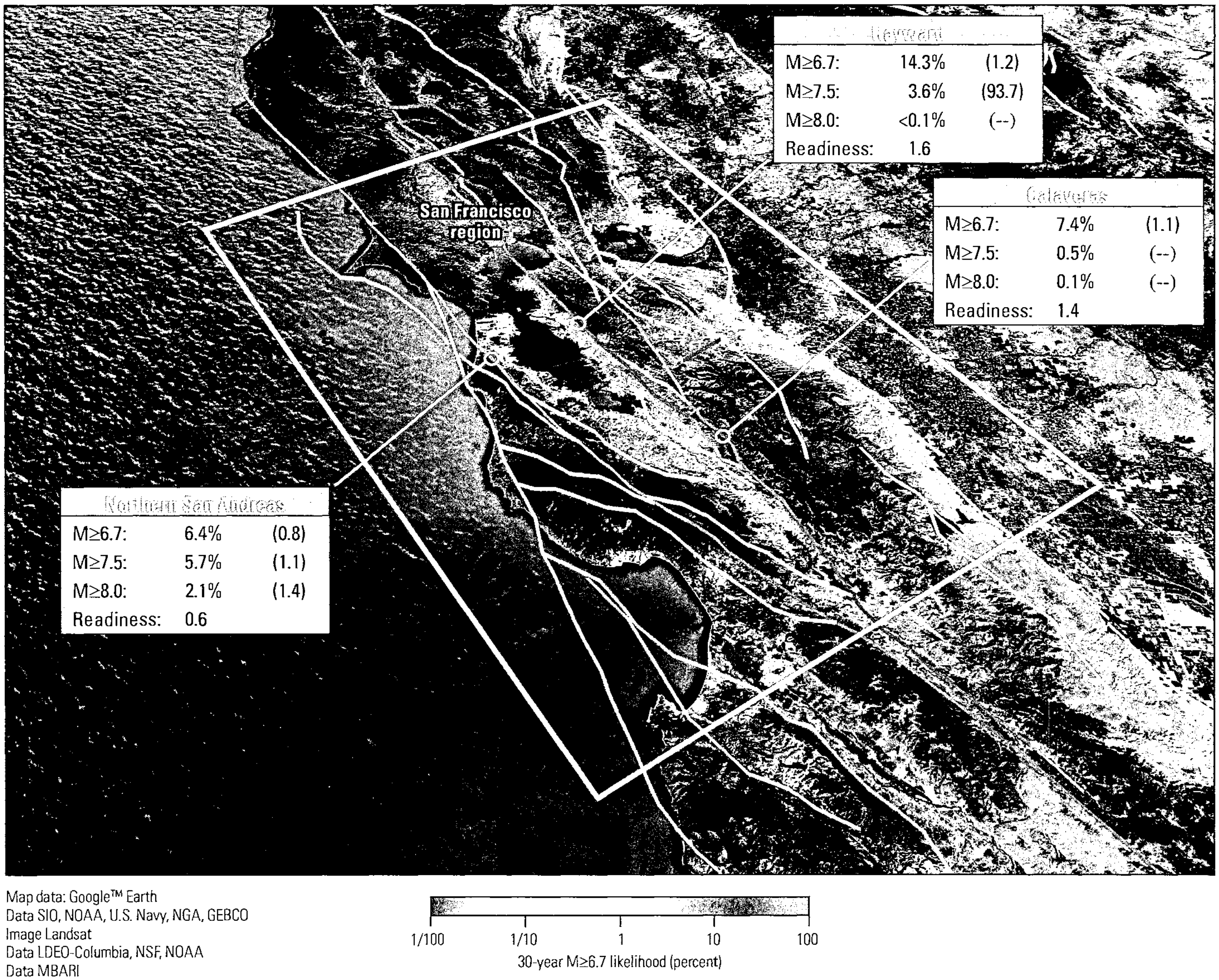
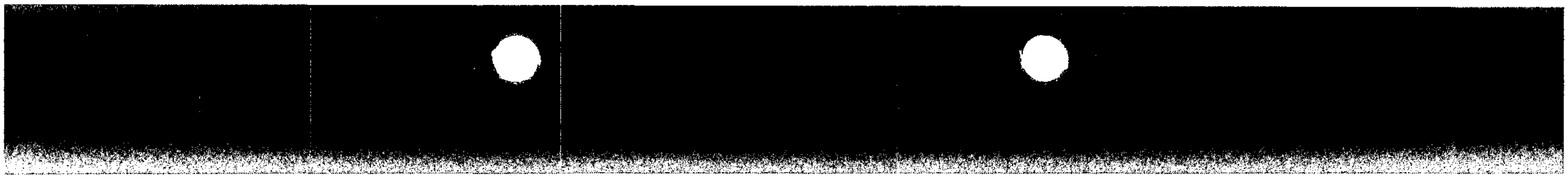


Figure 4. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near San Francisco, Calif.

efforts in the years to come, including engineering design of buildings and lifelines, loss estimation for catastrophic bonds and other risk-linked securities, and emergency preparedness, all of which have the ultimate goal of increasing public safety and community resilience.

UCERF3 should also serve as a reminder that California is earthquake country, and residents should always be prepared. Simple safeguards include practicing "drop, cover, and hold on," securing items in your home and workplace that could fall during an earthquake, and storing seven-days worth of food and water. Homeowners can also consider structural retrofits, such as bolting the house to its foundation, as well as earthquake insurance options. For further guidance on how to prepare for, survive, and recover after big earthquakes, follow the Seven Steps to Earthquake Safety (http://www.earthquakecountry.org/sevensteps).

Although UCERF3 is a clear improvement over the previous model (UCERF2), it is still an approximation of the natural system. For example, it does not model the earthquake-triggering process that produces aftershocks, even though we know such events can be large and damaging. Through the National Earthquake Hazard Reduction Program (http://www.nehrp.gov), the U.S. Geological Survey and its partners will continue to conduct research aimed at improving our understanding of fault behavior and estimates of earthquake hazard in the future.



Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

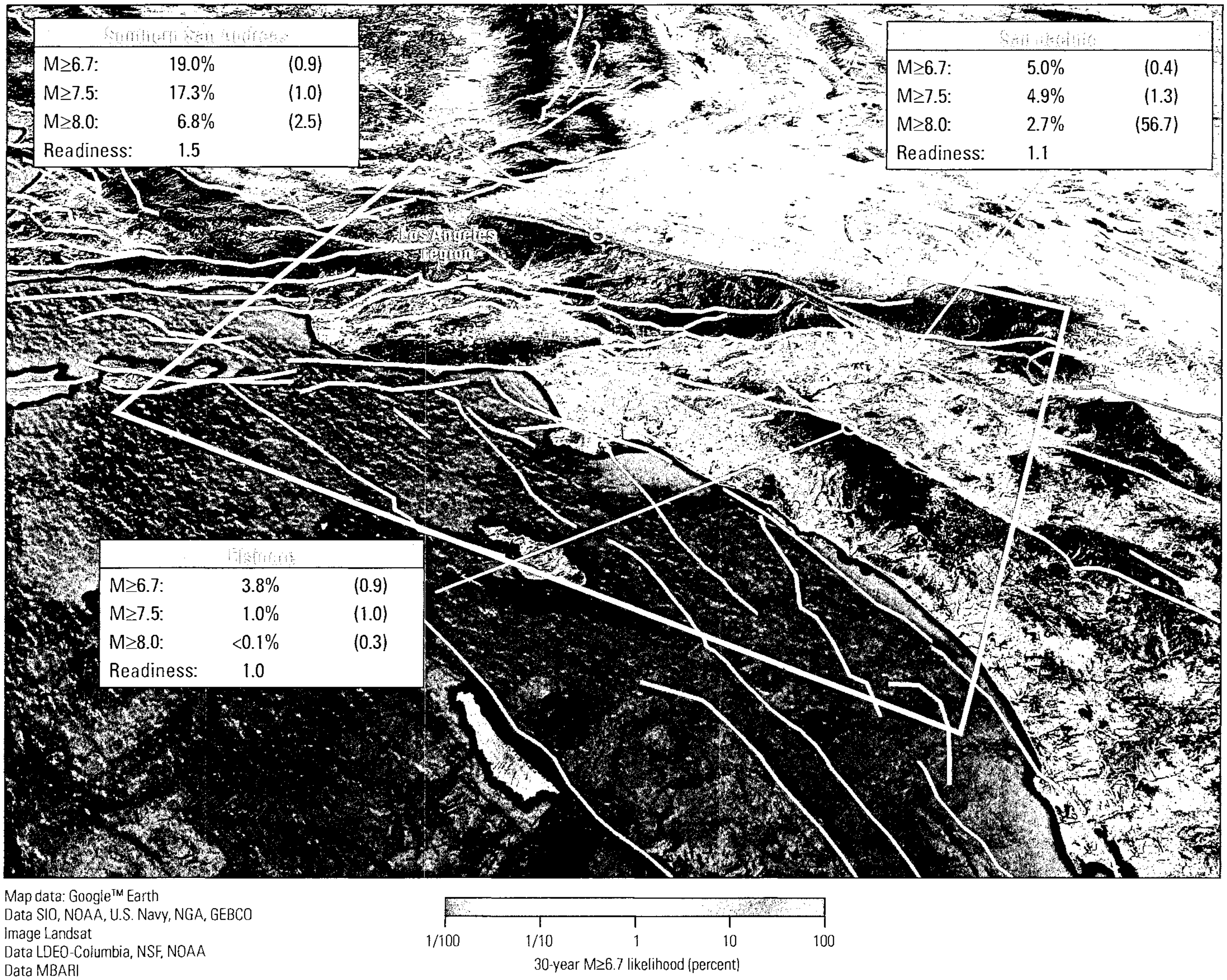


Figure 5. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near Los Angeles, Calif.

References

Korzybski, A. 1931, A non-Aristotelian System and its necessity for rigour in mathematics and physics: presention at the American Mathematical Society, December 28, 1931, New Orleans, Louisiana, meeting of the American Association for the Advancement of Science. Reprinted in Science and Sanity, 1933, p. 747–61.

Reid, H.F., 1911, The elastic-rebound theory of earthquakes: University of California Publications, Bulletin of the Department of Geological Sciences v. 6, p. 413–444.

Working Group on California Earthquake Probabilities, 2007, Published as: Field, E.H., Dawson, T.E., Felzer, K.R., Frankel, A.D., Gupta, V., Jordan, T.H., Parsons, T., Petersen, M.D., Stein, R.S. Weldon, II, R.J., and Wills, C.J., 2009, Uniform California earthquake rupture forecast, Version 2 (UCERF 2): Bulletin of the Seismological Society of America, v. 99, p. 2053–2107, doi:10.1785/0120080049.

Working Group on California Earthquake Probabilities, in press, Published as: Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R. Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C. Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J. II, , and Zeng, Y., 2015, Long-term, time-dependent probabilities for the third uniform California earthquake rupture forecast (UCERF3), Bulletin of the Seismological Society of America.

—*Authors: Edward H. Field and members of the 2014 WGCEP*

Cooperating organizations:
Southern California Earthquake Center (SCEC)
California Geological Survey (CGS)
California Earthquake Authority
U.S. Geological Survey

Additional Resources:

For general earthquake information contact:
1-888-ASK-USGS (1-888-275-8747)
http://earthquake.usgs.gov/
http://ask.usgs.gov
or
SCEC Education and Outreach: 213-740-3262

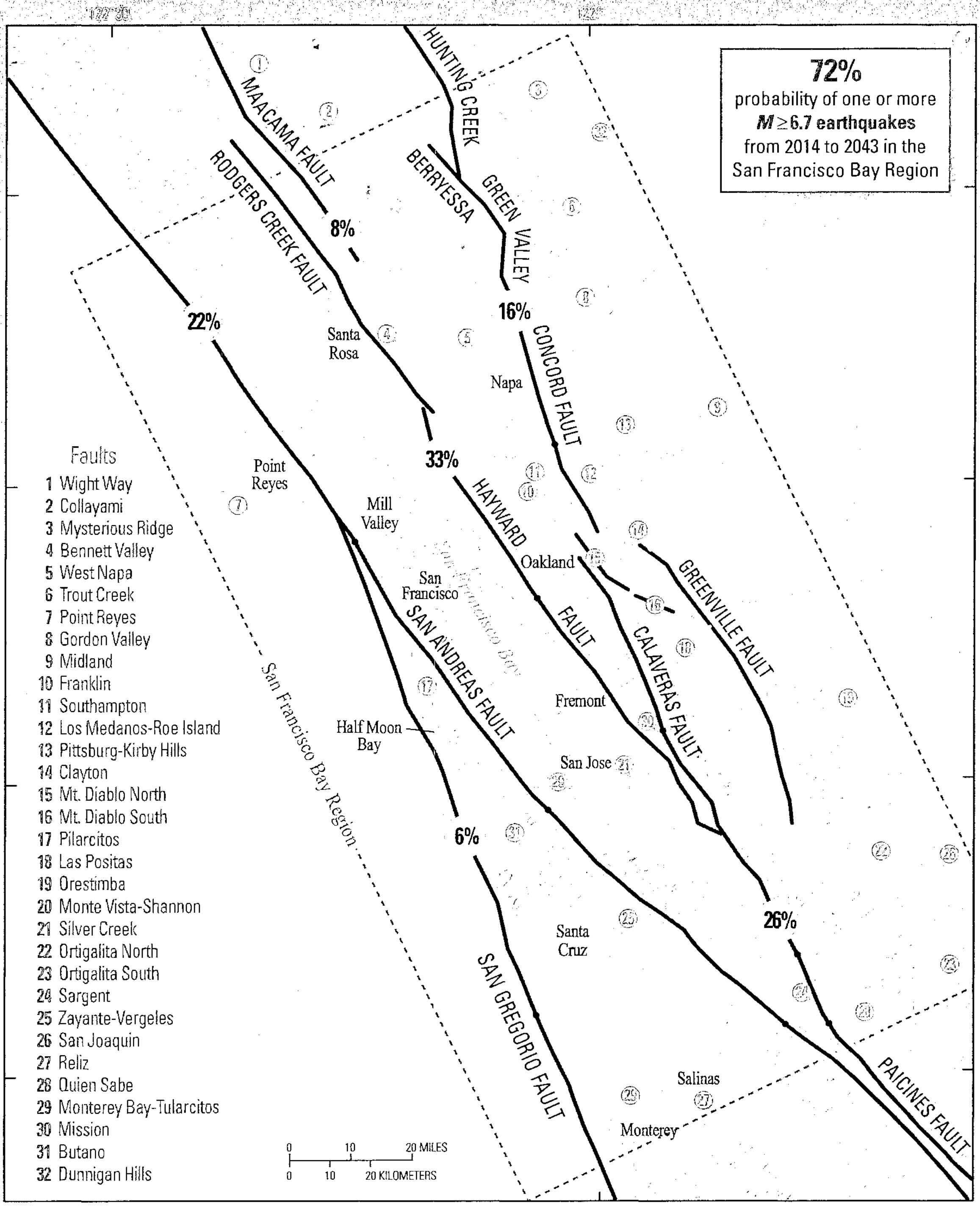
For UCERF3 information see:
http://www.WGCEP.org/UCERF3

For technical questions contact:
Edward (Ned) Field: field@usgs.gov

Appendix G

USGS
science for a changing world

Earthquake Outlook for the San Francisco Bay Region 2014–2043



EXPLANATION

Major plate boundary faults

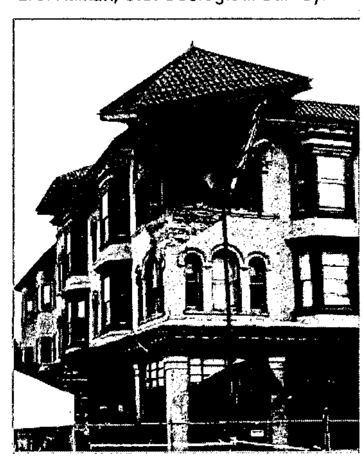
Lesser-known smaller faults

Urban areas

Map of known active faults in the San Francisco Bay region. The 72 percent probability of a magnitude 6.7 or greater earthquake includes the well-known major plate-boundary faults, lesser-known faults, and unknown faults. The percentage shown within each colored circle is the probability that a magnitude 6.7 or greater earthquake will occur somewhere on that fault system by the year 2043. The probability that a magnitude 6.7 or greater earthquake will involve one of the lesser-known faults is 13 percent.

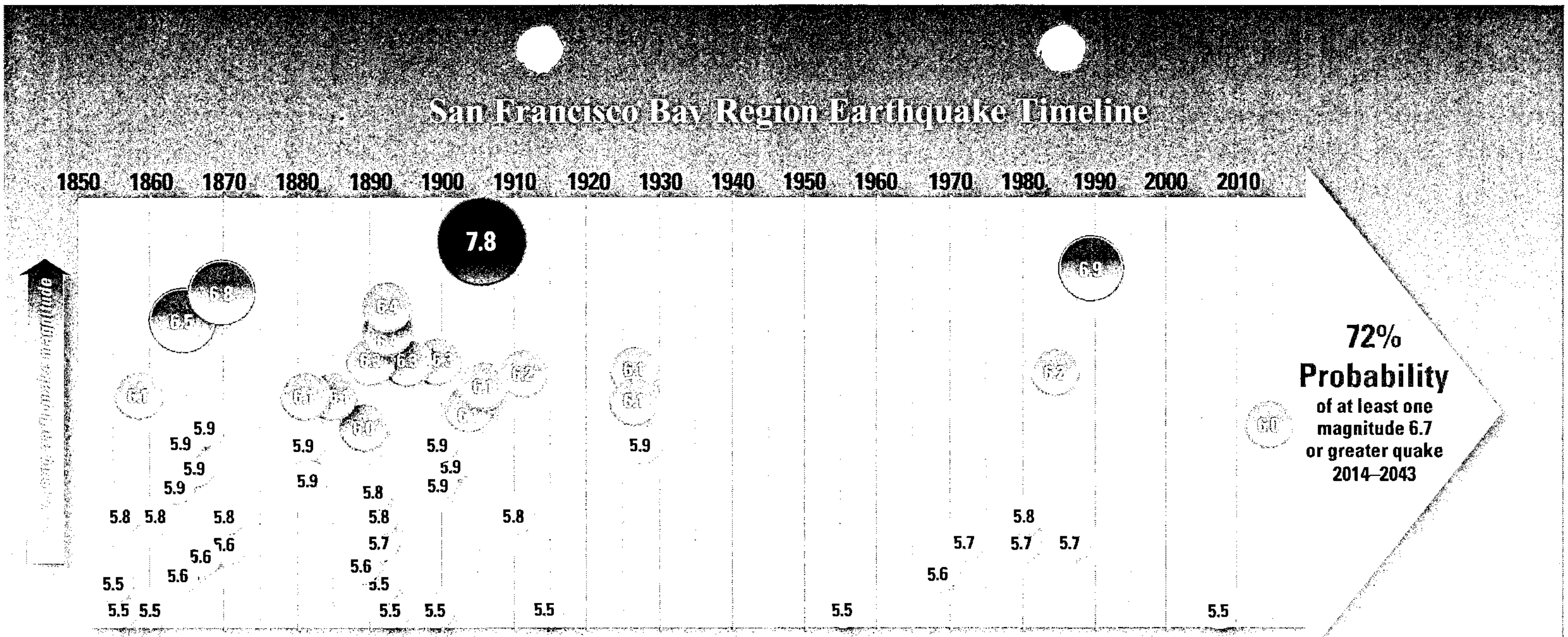
Using information from recent earthquakes, improved mapping of active faults, and a new model for estimating earthquake probabilities, the 2014 Working Group on California Earthquake Probabilities updated the 30-year earthquake forecast for California. They concluded that there is a 72 percent probability (or likelihood) of at least one earthquake of magnitude 6.7 or greater striking somewhere in the San Francisco Bay region before 2043. Earthquakes this large are capable of causing widespread damage; therefore, communities in the region should take simple steps to help reduce injuries, damage, and disruption, as well as accelerate recovery from these earthquakes.

Building damaged in 2014 South Napa earthquake. Photograph by Erol Kalkan, U.S. Geological Survey.



U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2016–3020
Revised August 2016 (ver. 1.1)



1850–1966 earthquakes from Bakun, W.H., 1999, Seismic Activity of the San Francisco Bay Region: Bulletin Seismological Society of America, v. 89, p. 764–784 and 1967–2014 earthquakes from the Northern California Seismic Network.

Likelihood of at least one earthquake greater than a given magnitude in the San Francisco Bay region between 2014 and 2043.

Magnitude (M)	30-year likelihood of at least one earthquake in the San Francisco Bay region
$M \geq 6.0$	98 percent
$M \geq 6.7$	72 percent
$M \geq 7.0$	51 percent
$M \geq 7.5$	20 percent

Timeline of magnitude 5.5 and greater earthquakes in the San Francisco Bay region 1850–2014. In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.

Earthquake Preparedness Helps

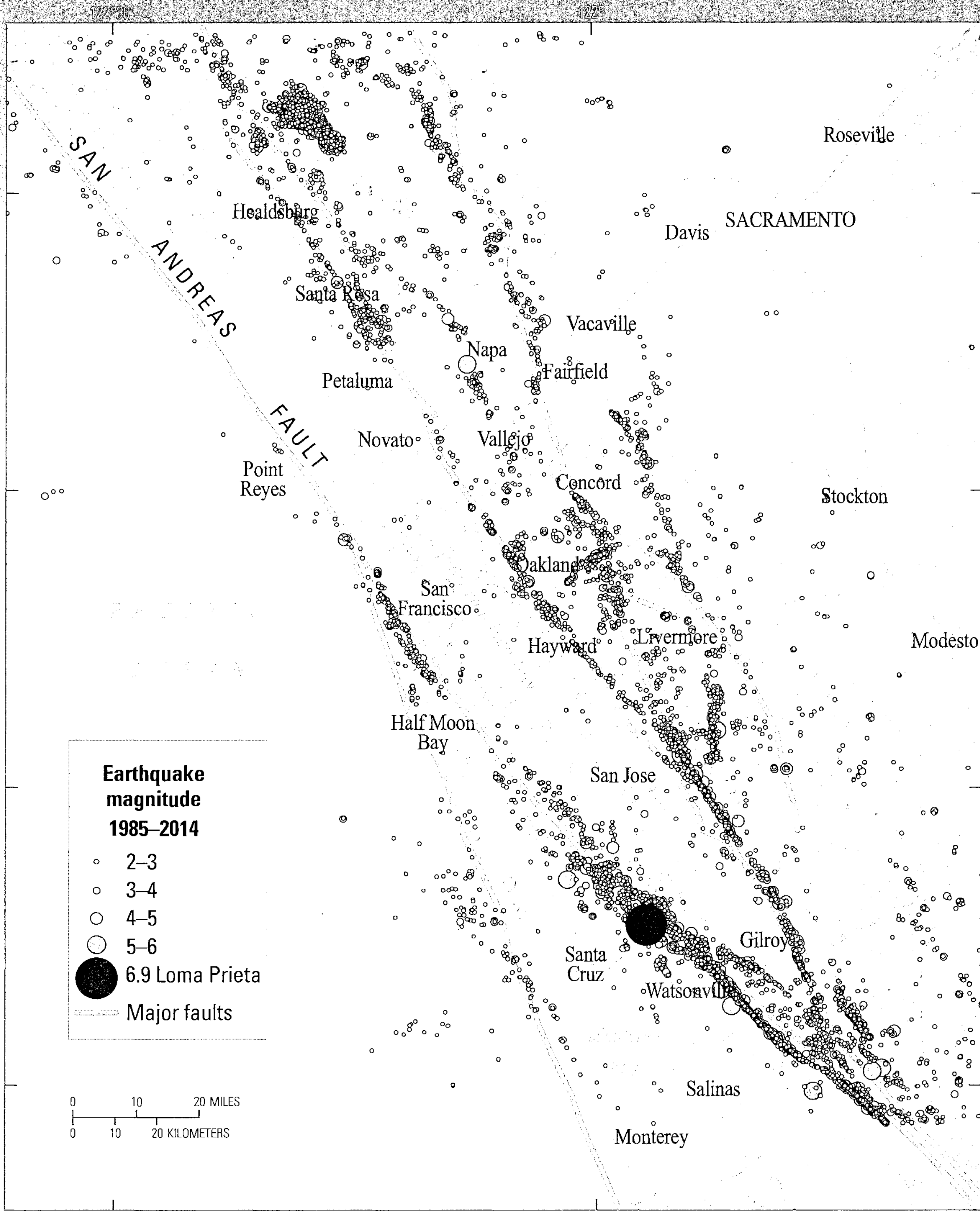
Early Sunday morning on August 24, 2014, the residents of Napa, California, were jolted awake by a strong, magnitude 6.0 earthquake. Within 30 minutes, the staff of Becoming Independent, a non-profit organization that helps adults with intellectual disabilities lead independent lives, called the people they serve in the affected area. The staff quickly visited all of the clients that needed help with cleanup and making their homes safe, a task made easier because both groups were trained in disaster preparedness and the clients had emergency kits with needed supplies on hand. The South Napa earthquake shifted houses off their foundations, damaged chimneys, started fires, and broke water mains throughout the city, causing hundreds of millions of dollars in economic losses. Many historic masonry buildings in downtown Napa were damaged. The earthquake was the largest in the San Francisco Bay region since the 1989 magnitude 6.9 Loma Prieta earthquake and a clear reminder of the seismic vulnerability of the region. The staff and clients of Becoming Independent showed that understanding and preparing for these events can improve how we live with future earthquakes.

Why Does the San Francisco Bay Region Have Earthquakes?

The same geologic process that is responsible for the San Francisco Bay region's beautiful coastlines, bays, hills, and valleys is also the primary driving force for earthquakes along faults in the region. The Bay region is located within the active boundary between the Pacific and the North American tectonic plates, where the Pacific plate slowly and continually slides northwest past the North American plate. The San Andreas Fault, on which two magnitude 7.8–7.9 earthquakes have occurred in historical time, including the 1906 San Francisco earthquake, is the fastest slipping fault along the plate boundary. Other major plate boundary faults in the San Francisco Bay region include the Hayward, Rodgers Creek, Calaveras, Maacama, San Gregorio, Concord, Green Valley, and Greenville Faults.

How Do Scientists Calculate Earthquake Probability?

Scientists rely upon a variety of techniques to help understand the rate and magnitude of past earthquakes in order to estimate the likelihood of future earthquakes. The Global Positioning System (GPS) and other land surveying and geologic techniques have allowed scientists to make more accurate measurements of how the current plate motions—totaling 1.6 inches per year across the San Francisco Bay region—distribute stress onto these individual faults. Balancing plate motions with the slip during large earthquakes and slow creep on faults allows scientists to calculate average rates of earthquake occurrence over periods of hundreds to thousands of years. (Continued on page 4)



Map of earthquakes greater than magnitude 2.0 in the San Francisco Bay region from 1985–2014. Small earthquakes occur on both major faults (shown by the gray lines) and minor faults (not shown). Because of the variability of fault geometry, earthquakes at depth do not always coincide with the mapped faults at the Earth's surface. There are sections of major faults, particularly the San Andreas Fault, with few or no small earthquakes but they will produce large earthquakes in the future. Compiled from the Northern California Seismic Network.

(Continued from page 2). A trench excavated across the Hayward Fault in Fremont revealed evidence of 12 large earthquakes over the past 1,900 years. The time interval between these earthquakes ranged from about 100 to 210 years. Historical records indicate that the most recent large earthquake on this fault occurred in 1868. However, detailed information about other past earthquakes in the San Francisco Bay region is difficult to obtain because seismograph records only go back to about 1900, historical accounts are sparse before 1850, and there are limited locations where faults can be trenched to identify and date prehistoric earthquakes.

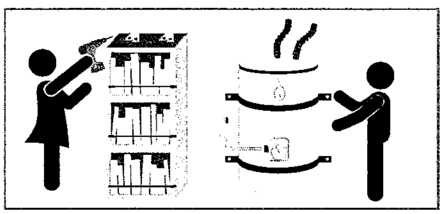
Calculating accurate earthquake probabilities for short periods, such as 30 years, is also challenging. Although the 30-year time interval is convenient for humans, it is much less than the average time between large earthquakes on these faults, which can range from hundreds to thousands of years. The rate of large earthquakes in the San Francisco Bay region was high in the late 1800s but dropped abruptly after the 1906 San Francisco earthquake on the San Andreas Fault. Scientists believe that the post-1906 earthquake rate decreased because the large amount of slip along the San Andreas Fault in 1906 temporarily reduced the stress on many of the faults in the region. However, the ongoing motion of the tectonic plates began rebuilding stresses after the 1906 event, and earthquakes larger than magnitude 5.5 resumed during the second half of the 20th century. Future large, damaging earthquakes in the San Francisco Bay region, similar in size to the 1989 Loma Prieta and 1906 San Francisco earthquakes, may or may not be accompanied by the level of earthquake activity observed in the late 1800s.

The 2014 Uniform California Earthquake Rupture Forecast version 3 (http://pubs.usgs.gov/fs/2015/3009/) provides an updated estimate of the likelihood of large earthquakes in California over a 30-year time window from 2014 to 2043. The forecast accounts for how fast stress is accumulating on each fault due to plate motions and the time since its most recent large earthquake(s). In updating the probability calculations, scientists used a more complete set of faults for the San Francisco Bay region than those used in the previous (2008) calculations, adding 32 smaller faults to the 5 major fault systems. The new study has also incorporated more options for how multiple faults might rupture together in large earthquakes.

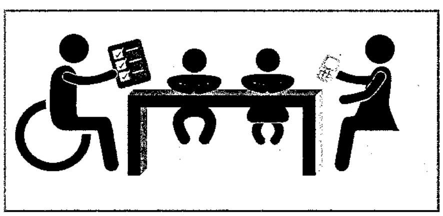
Seven Steps to Earthquake Safety

PREPARE

Before the next big earthquake we recommend these four steps that will make you, your family, or your workplace better prepared to survive and recover quickly:



Step 1: Secure your space by identifying hazards and securing moveable items.



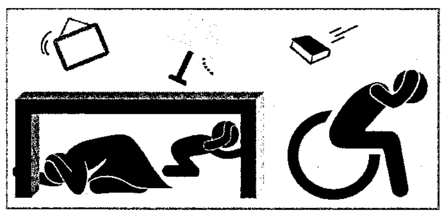
Step 2: Plan to be safe by creating a disaster plan and deciding how you will communicate in an emergency.

Step 3: Organize disaster supplies in convenient locations.

Step 4: Minimize financial hardship by organizing important documents, strengthening your property, and considering insurance.

SURVIVE

During the next big earthquake, and immediately after, is when your level of preparedness will make a difference in how you and others survive and can respond to emergencies:

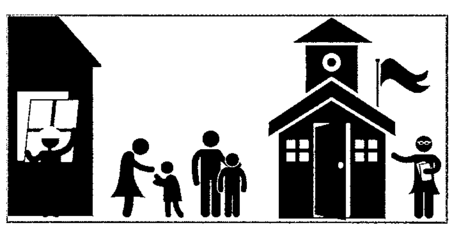


Step 5: Drop, Cover, and Hold On when the earth shakes.

Step 6: Improve safety after earthquakes by evacuating if necessary, helping the injured, and preventing further injuries or damage.

RECOVER

After the immediate threat of the earthquake has passed, your level of preparedness will determine your quality of life in the weeks and months that follow:



Step 7: Reconnect and Restore. Restore daily life by reconnecting with others, repairing damage, and rebuilding community.

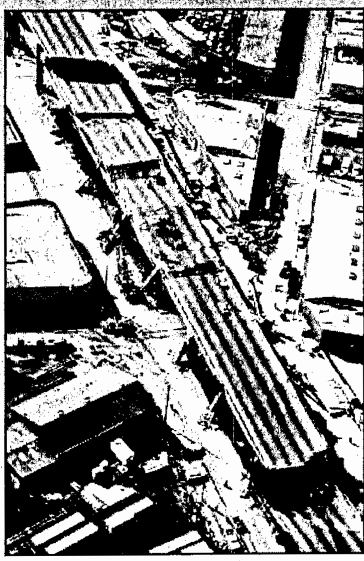
Adapted from Seven Steps To Earthquake Safety
http://earthquakecountry.org/sevensteps/

Probabilities of Earthquakes in the San Francisco Bay Region

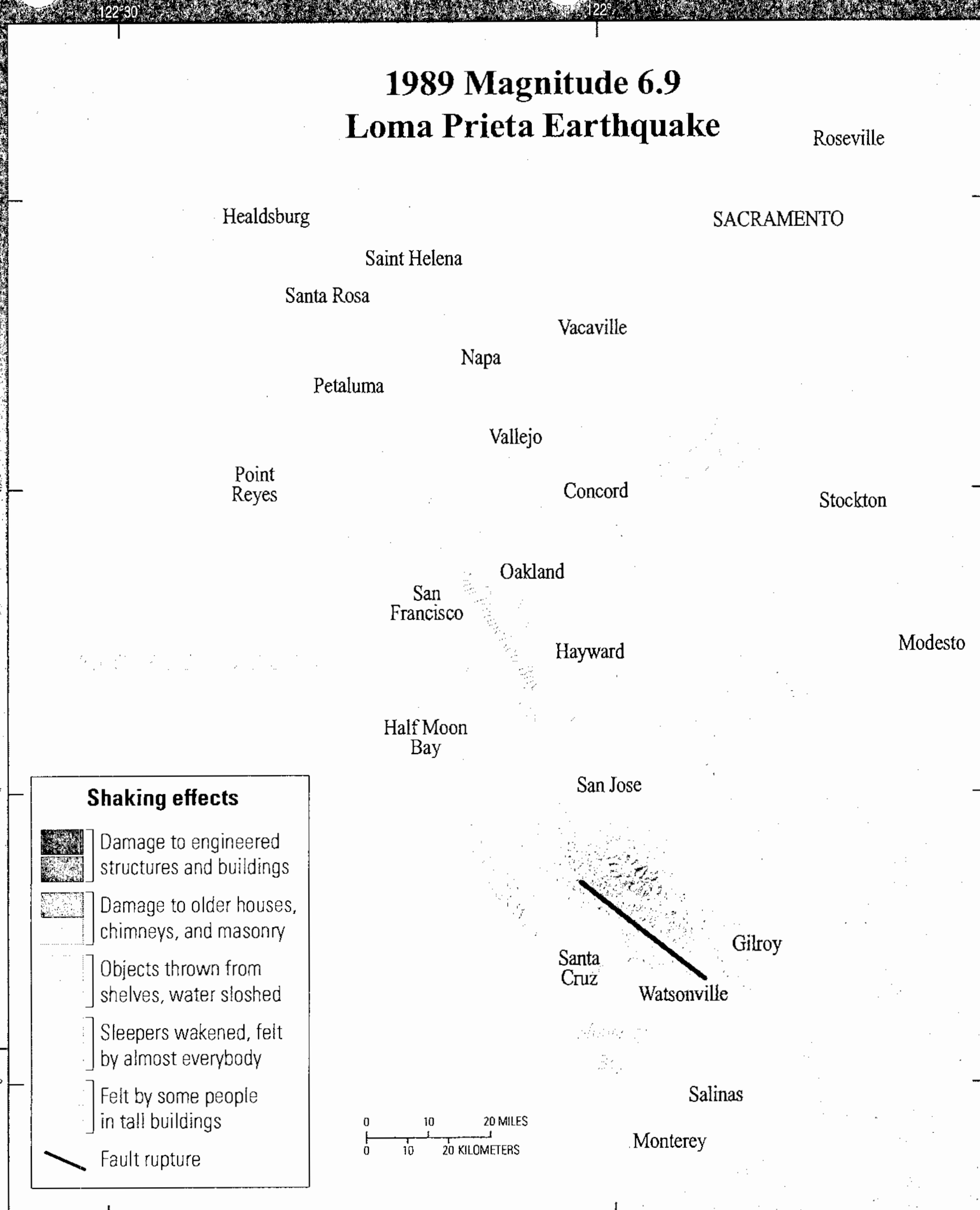
Smaller earthquakes occur more frequently than larger earthquakes. The probability that an earthquake of magnitude 6.0 or larger will occur before 2043 is 98 percent. The probability of at least one earthquake of magnitude 6.7 or larger in the San Francisco Bay region is 72 percent, and for at least one earthquake of magnitude 7.0 or larger it is 51 percent. These probabilities include earthquakes on the major faults, lesser-known faults, and unknown faults.

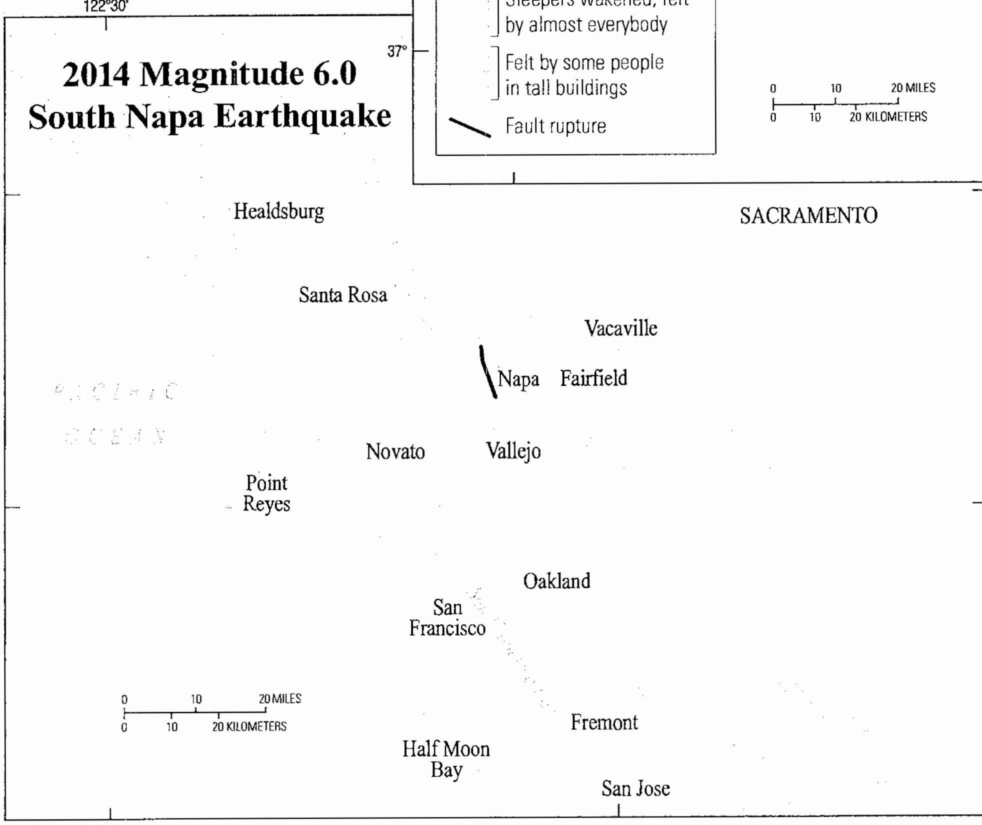
The probability of a large earthquake occurring on an individual fault in the San Francisco region is lower than the probability of an earthquake occurring anywhere in the region. The faults in the region with the highest estimated probability of generating damaging earthquakes between 2014 and 2043 are the Hayward, Rodgers Creek, Calaveras, and San Andreas Faults. In this 30-year period, the probability of an earthquake of magnitude 6.7 or larger occurring is 22 percent along the San Andreas Fault and 33 percent for the Hayward or Rodgers Creek Faults. Individual sections of these faults have lower probabilities for large earthquakes to occur (continued on page 6);

Maps showing intensity of ground shaking for the South Napa and Loma Prieta earthquakes. The black lines show the location of fault slip at depth. The maps illustrate how the area subjected to strong shaking increases with increasing earthquake magnitude.



Road damage from the Loma Prieta earthquake. Photograph by H.G. Wilshire, U.S. Geological Survey.





Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

Additional Earthquake Resources

American Red Cross – Bay Area (http://www.redcross.org/local/northern-california-coastal)
Association of Bay Area Governments (http://resilience.abag.ca.gov/earthquakes/)
Bay Area Earthquake Alliance (http://bayquakealliance.org/)
California Earthquake Authority (http://www.californiarocks.com/)
California Geological Survey (http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes)
Did You Feel It? (http://earthquake.usgs.gov/earthquakes/dyfi/)
Earthquake Country Alliance (http://earthquakecountry.org/)
Putting Down Roots in Earthquake Country (http://pubs.usgs.gov/gip/2005/15/)
ShakeAlert – An Earthquake Early Warning System for the United States West Coast (http://pubs.usgs.gov/fs/2014/3083/)
ShakeMap (http://www.cisn.org/shakemap/nc/shake/index.html)
ShakeOut.org (http://www.shakeout.org/california/bayarea/)
Uniform California Earthquake Rupture Fault version 3 Fact Sheet (http://pubs.usgs.gov/fs/2015/3009/)
United Policyholders (http://www.uphelp.org/)
USGS Real-Time Earthquakes (http://earthquake.usgs.gov/earthquakes/map/)

Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

(continued from page 5) however, an earthquake of magnitude 6.7 or larger will cause strong shaking over a broad area. Therefore, it is important to estimate the probability of a large earthquake occurring anywhere in the San Francisco Bay region.

What is the Likelihood That an Earthquake Will Affect You?

Earthquake probabilities are only one component in the evaluation of earthquake hazards. Higher magnitude earthquakes have broader areas of intense shaking and cause more damage than lower magnitude earthquakes. In a magnitude 6.0 earthquake, strong shaking and damage are confined to a localized area, as illustrated by the 2014 South Napa earthquake. In comparison, the 1989 magnitude 6.9 Loma Prieta earthquake caused damage over a region nearly 100 miles long. Local soil and geologic conditions, bedrock type, quality of building construction, and susceptibility to flooding (caused by dam or levee failure) can also affect the amount of damage at a particular site. This was dramatically demonstrated by the 1989 Loma Prieta earthquake, which devastated vulnerable parts of Oakland and San Francisco, more than 50 miles from the fault rupture.

How Can You Protect Yourself and Your Family?

Taking simple steps before and during earthquakes can help protect you and your family, as well as speed your recovery from an earthquake.

Before the next earthquake:

- Assess your home and work space, identify hazards, and secure moveable items.
- Create an emergency plan and organize disaster supplies to sustain you and your family for 72 hours or longer.
- Practice "Drop, Cover, and Hold On" to protect yourself when the ground begins to shake. Learn and practice what to do at home, work, or in school.
- Stay prepared by repeating these steps on a regular basis. For example, reassess your preparedness every year and participate in the annual Great California ShakeOut drill on the third Thursday in October.

Lack of adequate shear walls on the garage level exacerbated damage to this building at the corner of Beach and Divisadero in the Marina District, San Francisco, during the October 1989 Loma Prieta earthquake.

Brad T. Aagaard, James Luke Blair, John Boatwright, Susan H. Garcia Ruth A. Harris, Andrew J. Michael, David P. Schwartz, and Jeanne S. DiLeo

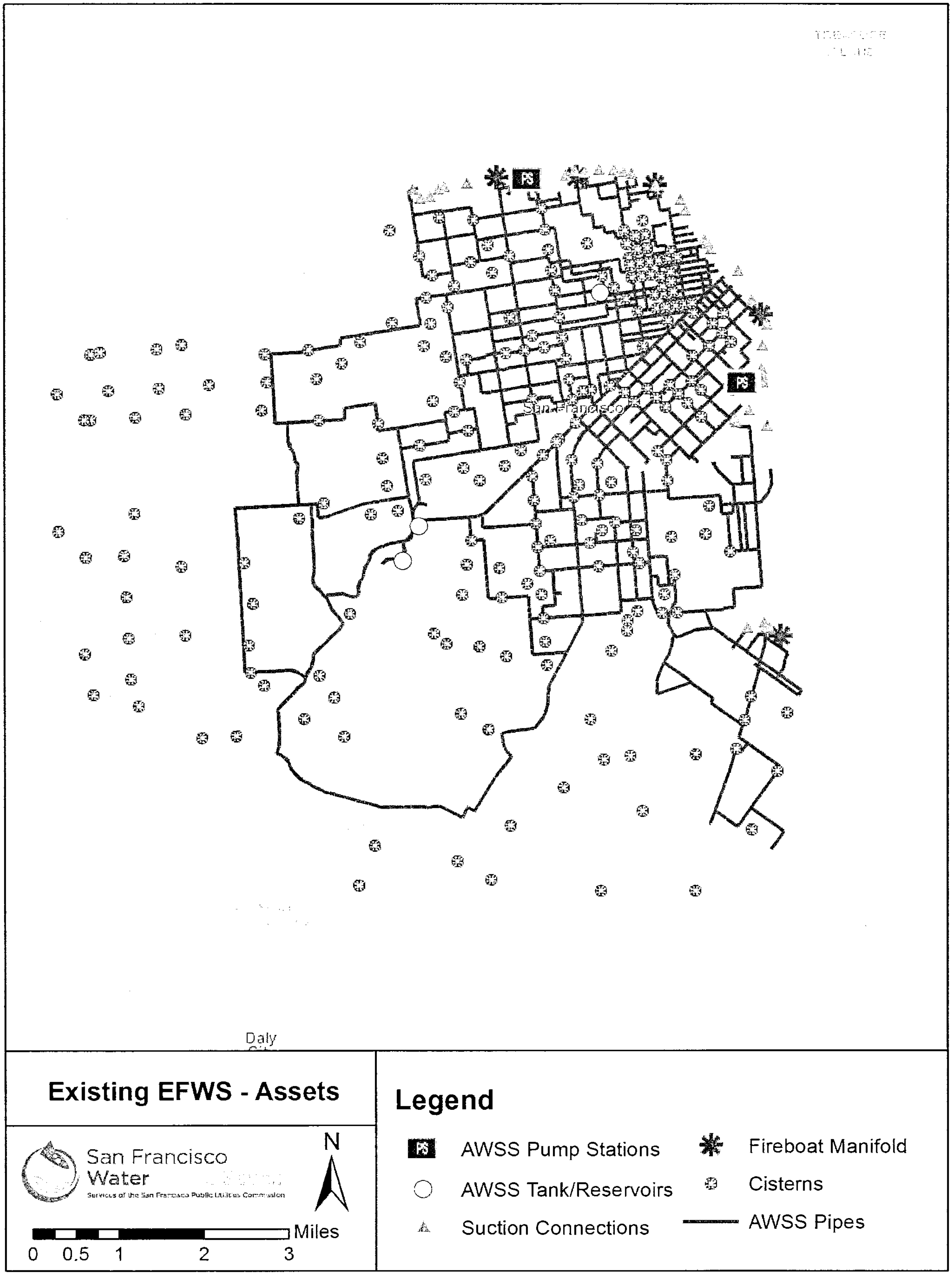
Edited by *Kate Jacques* and *Carolyn Donlin*

For more information contact:
1-888-ASK-USGS
(1-888-275-8747)

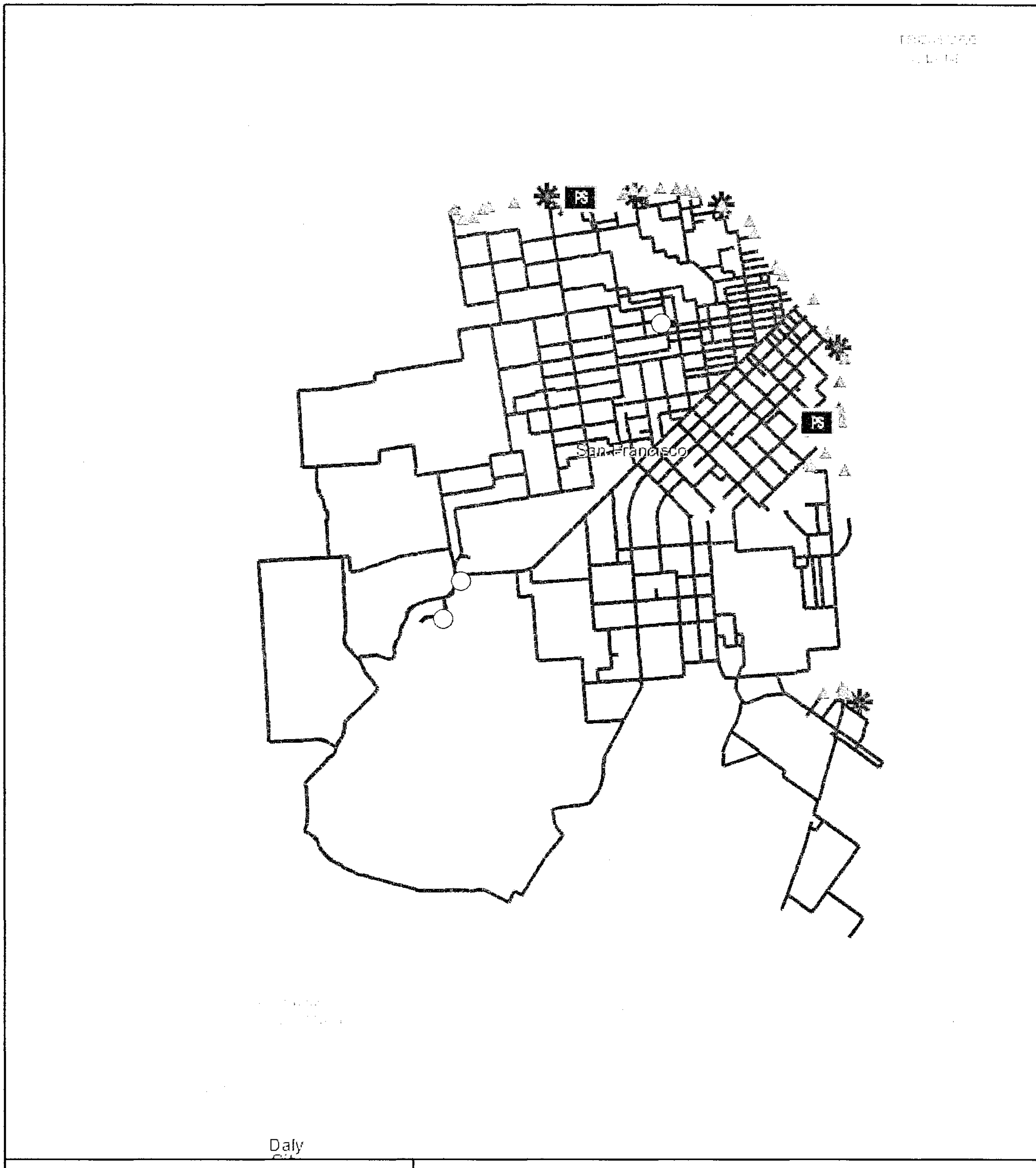
http://earthquake.usgs.gov/
http://ask.usgs.gov
https://www.facebook.com/USGeologicalSurvey
https://twitter.com/USGS

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20163020

Appendix H


San Francisco
Daly
Existing EFWS - Assets
San Francisco
Water
N
Miles
0 0.5 1 2 3
Legend
AWSS Pump Stations
AWSS Tank/Reservoirs
Suction Connections
Fireboat Manifold
Cisterns
AWSS Pipes

Appendix I



Existing EFWS - Pipelines

San Francisco Water

Services of the San Francisco Public Utilities Commission

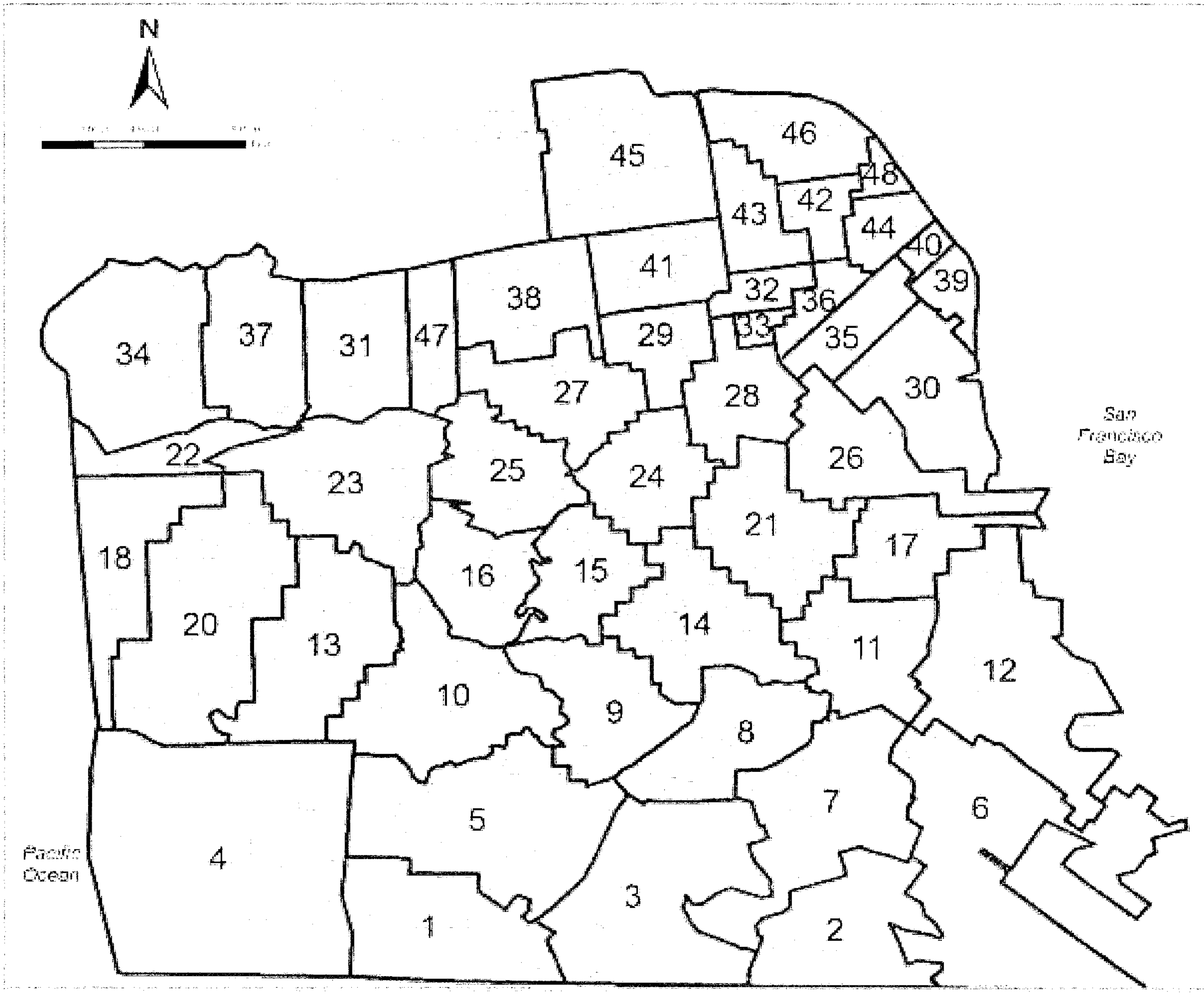
N

0 0.5 1 2 3 Miles

Legend

- AWSS Pump Stations
- Fireboat Manifold
- AWSS Tank/Reservoirs
- AWSS Pipes
- Suction Connections

Appendix J



Legend

Fire Response Area

Appendix K

Abstract

San Francisco is at significant risk due to fire following earthquake. This report analyzes fire following earthquake for San Francisco as part of a larger project undertaken by the San Francisco Department of Building Inspection entitled Community Action Plan for Seismic Safety (CAPSS). This specific report, on fire following earthquake, has been conducted with the support and assistance of the San Francisco Fire Department (SFFD).

A stochastic model for analyzing fire following earthquake for San Francisco has been developed, utilizing data received from CAPSS, SFFD and others, to assess fire following earthquake impacts due to four earthquake scenarios: magnitude 7.9, 7.2 and 6.5 events on the San Andreas fault near San Francisco, and a magnitude 6.9 event on the Hayward fault. These events cause high ground motions in San Francisco that result in ground failure in many parts of the City – ground motions are particularly high in the western part of San Francisco, which was not yet built up in 1906 and therefore is not protected by the special high pressure SFFD Auxiliary Water Supply System (AWSS). Depending on the specific earthquake scenario, these ground motions and ground failures are estimated to cause over 1,000 breaks in the potable water system, so that SFFD's AWSS and cisterns will be the only source of firefighting water in many parts of the City. The AWSS itself will sustain some damage, forcing SFFD to fall back to cisterns only in some places. At the same time, SFFD's 42 fire engines will almost certainly not be able to respond to all the post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for the magnitude 7.9 San Andreas event. As a result, the methodology employed here estimates ignitions, building burnt areas and dollar losses for the four scenario events. These results are presented in Table A-1 as ranges within which losses will fall half (i.e., 50%) of the time (correspondingly, half the time the losses will be outside – that is, either more or less) than the indicated ranges: .

Table A-1
Bounds for Losses to Buildings due to Fire Following Earthquake

	25% ~ 75% Confidence Range		
	Ignitions	Loss $ billions	**Total Burnt Building Floor Area** mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~ 28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

For example, for the Mw 7.9 event, essentially a repeat of the 1906 earthquake, losses will on average be about $7.6 billion, and half the time will be more than $4.1 billion and less than $10.3 billion. More detailed results are presented in the report, but the significance of these results is not in their precision, but rather in their overall magnitude. The model producing these results was validated by application to the 1989 Loma Prieta event, and examined for methodological and parametric sensitivity, with satisfactory results.

A number of opportunities exist for reducing the fire following earthquake in San Francisco, including further improvements in reliability of post-earthquake water supply, further support for NERT, and greater training for this problem for SFFD officers and firefighters.

Appendix L

Fire Protection Bonds **A**

PROPOSITION A

FIRE PROTECTION SYSTEM IMPROVEMENT BONDS, 1986. To incur a bonded indebtedness of $46,200,000 for the improvement of the fire protection system within the City and County of San Francisco.

YES 273 ➡
NO 274 ➡

Analysis

by Ballot Simplification Committee

THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.

THE PROPOSAL: Proposition A would authorize the City to borrow $46,200,000 by issuing general obligation bonds. This money would pay for improvements in San Francisco's fire protection system. These improvements would include extending the high pressure system, construction of new cisterns in residential areas, installation of a high pressure pump station at Lake Merced, construction of an emergency operations center, and other projects. The interest and principal on general obligation bonds are paid out of tax revenues. Proposition A would require an increase in the property tax.

A YES VOTE MEANS: If you vote yes, you want San Francisco to issue general obligation bonds totalling $46,200,000 to make certain improvements in the City's fire protection system.

A NO VOTE MEANS: If you vote no, you do not want San Francisco to issue bonds for these improvements in the City's fire protection system.

Controller's Statement on "A"

City Controller John C. Farrell has issued the following statement on the fiscal impact of Proposition A:

"Should the proposed Resolution be authorized and when all bonds shall have been issued on a twenty (20) year basis and after consideration of the interest rates related to current municipal bond sales, in my opinion, it is estimated that approximate costs would be:

Bond Redemption	$46,200,000
Bond Interest	38,808,000
Debt Service Requirement	$85,008,000

"Based on a single bond sale and level redemption schedules, the average annual debt requirement for twenty-two (22) years would be $3,864,000 which amount is equivalent to approximately one and twenty hundreths cents ($0.0120) in the current tax rate."

How "A" Got on the Ballot

On July 28 and August 4 the Board of Supervisors voted 8–0 in favor of the ordinance placing Proposition A on the ballot.

The ordinance was signed by Mayor Dianne Feinstein on August 6.

THE FULL LEGAL TEXT OF PROPOSITION A APPEARS ON PAGE 96

NOTE: YOUR POLLING PLACE MAY HAVE CHANGED. PLEASE REFER TO MAILING LABEL ON BACK COVER.

NO ARGUMENT WAS SUBMITTED AGAINST PROPOSITION A

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

In 1906, as dawn was about to break on April 18, a giant earthquake hit the City, touching off 52 separate fires. Those downtown swiftly joined in a huge conflagration that swept westward from the waterfront, leaving much of the City in ruins.

If another major quake strikes—(and seismic experts say it will, but they can't pinpoint when), the City must be prepared.

Our firefighters must have sufficient water to fight spreading fires and quickly to control them. That's the only way our City will survive.

In 1906, water mains broke and left the City defenseless.

Proposition A will assure adequate water in every neighborhood throughout the City.

Proposition A will provide $46 million in general obligation bonds to expand and improve emergency water supplies throughout the City. Residential areas will be provided with underground cisterns, and the high-pressure water supply system will be extended. Suction hose connections to City lakes, San Francisco Bay and the Pacific Ocean will provide additional millions of gallons of water.

These emergency fire-fighting water supplies are necessary to protect our homes, schools, hospitals, churches and other structures from the threat of fire that inevitably comes with a monstrous quake.

This increased fire protection will benefit the entire City and all who live, work and vist here.

Vote Yes on Proposition A.

Dianne Feinstein, Mayor

ARGUMENT IN FAVOR OF PROPOSITION A

As a result of the earthquake and fire in 1906, San Francisco suffered great destruction and devastation from the conflagration which followed, including the destruction of 28,000 buildings.

Due to broken water mains caused by the earthquake, the San Francisco Fire Department was unable to stop the fire from getting out of control.

Proposition A will provide for the expansion of a high pressure fire-fighting water system to the residential districts of the City, which will be critical in emergency situations.

Underground cisterns also will be constructed in the outer residential districts to provide emergency water supply in areas not served by the high pressure system.

High pressure system gate valves will be motorized with emergency battery powerpacks so they can be opened and closed in an emergency when normal power is disrupted.

Suction connections will be provided to San Francisco Bay, the Pacific Ocean, and City lakes so that fire department pumpers can quickly connect and pump water from these large bodies of water to any fires.

A pumping station for the high pressure system will be constructed at Lake Merced to provide an important source of water from the western part of the City.

An Emergency Operations Center will be built to provide a command center for operations in earthquakes and other major disasters.

The recent fire and explosion in the Hunter's Point district demonstrated the critical need for water supplies in a major fire. The broken water main caused by the explosion severely hampered the Fire Department in controlling this major fire. This is an example of what can happen when normal water supplies are disrupted.

Increased earthquake activity in California demonstrates the importance of this Proposition.

The fire department can function only if an adequate water supply exists. Proposition A will provide an emergency fire-fighting water supply for the City, and ensure that fires will not get out of control due to lack of water, following an earthquake.

We urge all citizens to vote yes on Proposition A. This is protection for your home and your City.

—Submitted by the Board of Supervisors

ARGUMENT IN FAVOR OF PROPOSITION A

The Fire Commission and Chief of Department urge a YES vote on Propositon A—a $46.2 million Earthquake Preparedness Program.

This construction Program is designed to provide an updated and expanded emergency water supply system so that all areas of the City and County of San Francisco will be protected in case of a conflagration following an earthquake or other disaster.

The major components of the Program are: high-pressure water supply extensions, underground cisterns, pumping station, emergency operations center, suction hose connections to the Bay and lakes, and a study to determine fire station reconstruction needs and their earthquake safety.

Help the San Francisco Fire Department provide increased fire protection. **VOTE YES ON PROPOSITION A.**

Henry E. Berman, President, Fire Commission
Curtis McClain, Vice President, Fire Commission
Juanita Del Carlo, Commissioner, Fire Commission
Richard J. Guggenhime, Commissioner, Fire Commission
Anne S. Howden, Commissioner, Fire Commission
Emmet D. Condon, Chief of Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans will not forget, nor should they, the tragic Bayview/Hunter's Point fire on April 4, 1986. Coincidentally, two earthquakes rocked the Bay Area in the weeks following the Bayview fire.

Following the Bayview fire, I requested Board of Supervisors hearings to investigate the adequacy of San Francisco's emergency water supply in the Bayview, Ingleside, Balboa Terrace, Oceanview, Lakeside, Forest Hill, Crocker-Amazon, St. Francis Wood, West Portal, Diamond Heights, Visitacion Valley, Merced Manor, Excelsior, Portola, Silver Terrace, Miraloma Park, Forest Knolls, Inner Sunset, Lakeshore Acres, Monterey Heights, and Outer Mission neighborhoods, and to implement a program to correct deficiencies in our emergency firefighting capabilities. From these hearings and deliberations of the Fire Commission, Proposition A emerged.

VOTE YES ON A.

Proposition A is a $46,200,000 general obligation bond issue to construct a comprehensive emergency water supply system and an emergency operations center for firefighting in the event of a disaster.

That may seem like a lot of money, but it represents, in this case, a prudent, far-sighted investment in San Francisco's future. Unfortunately, we can't guarantee another Bayview-type fire won't happen. But we can be better prepared if one **does** happen, and significantly reduce the risk to life and property in the Bayview, Hunter's Point, the Outer Mission, and all of the West of Twin Peaks area.

Please vote "Yes" on A.

Quentin L. Kopp, Supervisor

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquakes are a major concern to all of us who live in California, and a potential cause of disaster for San Francisco. Following a major earthquake it is highly likely that multiple fires will occur. San Francisco with its highly congested blocks of wooden buildings would face a conflagration (fire storm), if a major earthquake caused water supplies to be disrupted.

Proposition A, as an Earthquake Preparedness measure, is very important for San Francisco. It will provide for Emergency Water Supply necessary for fire fighting.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Bruce Bolt, Professor of Seismology
Karl V. Steinbrugge, Past Chairman
California Seismic Safety Commission
Charles Scawthorn, Structural Engineer
Joe J. Litehiser, Seismologist
Donald H. Cheu, M.D., Vice Chairman
Governor's Earthquake Task Force

ARGUMENT IN FAVOR OF PROPOSITION A

We support this important Earthquake Preparedness Program.
VOTE YES ON PROPOSITION A.

Willie L. Brown, Jr., Speaker of Assembly
Michael Hennessey, Sheriff
Morris Bernstein, President, Airports Commission
Douglas Engmann, Commissioner, Board of Permit Appeals
E. L. Friend, President
Anne Halstead, Commissioner, Port Commission
Thomas E. Horn, President, War Memorial Board of Trustees
Melvin D. Lee, Commissioner, Redevelopment Commission
Robert J. McCarthy, Vice President, Board of Permit Appeals
Al Nelder, Commissioner, Police Commission
Michael Salarno, Member, S.F. Parking Commission
William K. Coblentz, Attorney
Gordon J. Lau, Attorney
Steven L. Swig, Attorney

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection for San Francisco's neighborhoods is a vital factor. Emergency Water Supplies for fire fighting are necessary so that the Fire Department can provide ample protection to our homes in the event an earthquake damages water mains as occurred in 1906.

Proposition A will expand and improve the Fire Department's Emergency Water Supplies.

- Suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- Underground cisterns will be provided in residential areas.
- The High-Pressure System will be extended to outer residential districts.

The cost of Proposition A is .0120 cent per $100 valuation on the property tax; this means a home valued at $150,000 would pay $17.16 per year for this protection. This is highly cost effective insurance for our homes.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Marguerite A. Warren
James J. Walsh, Jr.
Dorothy Agnes McDougall
Andrew Jones
George L. Newkirk
Jess T. Esteva
Dolph Andrews
Norman V. Wechsler

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection and Earthquake Preparedness concern all school officials in San Francisco.

Proposition A is an important program that will provide **Emergency Water Supplies For Fire Fighting** throughout the City.

When a major earthquake strikes, the Fire Department must have a dependable water supply to protect our families, homes and schools.

Earthquakes cannot be stopped, but we must have water to stop the fires that will occur.

We ask all citizens to join us and **VOTE YES ON PROPOSITION A.**

Myra A. Kopf, President, Board of Education
A. Richard Cerbatos, Vice President, Board of Education
Libby Denebeim, Member, Board of Education
JoAnne Miller, Member, Board of Education
Benjamin Tom, Member, Board of Education
Sodonia M. Wilson, Member, Board of Education
Rosario Anaya, Member, Board of Education
Ernest C. Ayala, President, S.F. Community College Board
Al Vidal, Principal, Washington High School

ARGUMENT IN FAVOR OF PROPOSITION A

Improved and expanded Emergency Water Supplies for fire fighting in San Francisco are a necessary factor to prevent another conflagration (fire storm) from sweeping the City as occurred in 1906.

Our central business and financial districts are the economic heart of the City, the residential districts contain the homes of our citizens.

Proposition A provides increased fire protection to our high-rise buildings and our homes.

Earthquake preparedness and protection from the ravages of fire concern us all. As civic leaders of San Francisco we urge all citizens to **VOTE YES ON PROPOSITON A.**

Lee Dolson, General Manager, Downtown Association
James R. Bronkema, President, Embarcadero Center

ARGUMENT IN FAVOR OF PROPOSITION A

We can bet that most of you have seen the circles of bricks encompassing certain intersections in some neighborhoods in San Francisco. These circles mark underground water cisterns that were constructed "after" the devastating earthquake and fire in 1906. Many neighborhoods in San Francisco built after 1912 are NOT serviced by this alternate water system.

Proposition A would provide a City-wide emergency water supply system to protect our homes and neighborhoods.

We cannot prevent earthquakes but we can take precaution against fire. . .the biggest threat to San Francisco.

We urge a YES vote on Proposition A. . .fire protection for our families no matter where they may be in our City.

Nancy Honig
Roxanne Mankin
Jane McKaskle Murphy
Bernice E. Ayala
Cheryl Arenson
Gina Moscone
Jonnie B. Johnson

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and increased fire protection are of vital concern to all citizens of San Francisco.

VOTE YES ON PROPOSITION A.

Robert Bacci
Michael Bernick
Susan Bierman
Frank T. Blackburn
Rev. Dr. Amos C. Brown
Sally Brunn
Stafford Buckley
Michael Chan
Charles D. Cresci
Rosemary DeGregorio
Todd Dickinson
H. Welton Flynn
Ron Huberman
Ralph Hurtado
David Jenkins
Agar Jaicks
Carole Migden
Polly V. Marshall
Alicia Wang
Thomas F. McDonough
Tony Kilroy
Leroy King
David Looman
Christopher Martin
Peter Mezey
Marilyn Miller
Jeff Mori
Sandy Mori
Yoshio Nakashima
Mitchell Omerberg
Edward J. Phipps
Linda Post
Thelma Shelley
Robert J. Tully
Yori Wada
Evelyn Wilson
Pansy Ponzio Waller
Bruce W. Lilienthal
Jim Wachob

ARGUMENT IN FAVOR OF PROPOSITION A

Pure self interest dictates that we provide an abundant and surplus supply of "fire protection" water for EVERY part of San Francisco, not just half of it! VOTE YES!

W. F. O'Keeffe, Sr., San Francisco Taxpayers Association

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

Emergency water supplies for fire fighting are vital for San Francisco. On April 4, 1986, an explosion and fire occurred in the Bayview District, causing nine deaths. The disrupted water supply caused by the explosion, severely hampered the Fire Department in controlling this fire.

In the event of a major earthquake it is highly likely that water mains will be damaged throughout San Francisco. Proposition A will provide for 94 underground cisterns to be built in residential areas where few emergency water supplies now exist. The Bayview fire demonstrated the need for emergency water supplies for fire fighting.

Protect your neighborhood and home.

VOTE YES ON PROPOSITION A.

Concerned Citizens for Improved Fire Protection

Michael Frew, Chairman
John Holt
Robert L. Kreuzberger
Ed F. Patterson
Michael S. Newman
Mel S. Newman
Jack R. Brower
August J. Nevolo

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans remember what happened in 1906. The fires that occurred after the earthquake swept the City and left many thousands of people homeless.

Proposition A is a common sense program to provide **Emergency Water Supplies for Fire Fighting** throughout the City. This would ensure that fires would not get out of control due to lack of water supply.

This $46.2 million bond issue needs a two-thirds vote. As a former member of the Board of Supervisors and neighborhood businessman, I urge all citizens to vote for this important program. It is protection for your family, home and city at a very low cost; it makes sense in both human and economic terms.

VOTE YES ON PROPOSITION A.

John Barbagelata, Realtor

ARGUMENT IN FAVOR OF PROPOSITION A

Proposition A assures San Francisco residents of on-going preparation which is the best defense against a major disaster— earthquake, conflagration, or an explosion.

San Francisco Fire Fighters regard this measure as the first-step in the earthquake preparedness program.

Control disaster with expanded fire protection!

San Francisco Fire Fighters urges a **YES** vote on Proposition A.

James T. Ferguson, President,
San Francisco Fire Fighters Local 798

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection is a serious concern for all citizens of San Francisco. We, the working Fire Chiefs of San Francisco are well aware of what happened in 1906, when fires occurring after the great earthquake burned thousands of buildings and left over 200,000 homeless.

The quake caused hundreds of breaks in water mains and the lack of water supplies prevented the Fire Department from controlling the fire.

We do not want this to happen again.

Proposition A will provide **Emergency Water Supplies for Fire Fighting.** The following installations will be placed in our neighborhoods to protect our homes.

- 94 underground cisterns will be built.
- 56 suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- The High-Pressure System will be extended to residential areas.
- Improvements to tanks, reservoirs, pump stations, including a new pump station at Lake Merced and an Emergency Operations Center.

The recent fire in the Bayview District that took nine lives demonstrated how important water supplies can be. The damaged water supply caused by the fire and explosion seriously hampered Fire Department efforts to control this major fire.

We as the working Fire Chiefs who actually run the day-to-day field operations in San Francisco urge all citizens to support this important measure.

VOTE YES ON PROPOSITION A.

John W. Flaherty
President, The San Francisco Fire Chiefs Association
Gary J. Torres
Secretary, The San Francisco Fire Chiefs Association

ARGUMENT IN FAVOR OF PROPOSITION A

Fire safety can be improved by voting FOR Proposition A and AGAINST BART director Eugene Garfinkle. BART's a fire trap.

Tom Spinosa, BART Board candidate

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and Fire Protection are vital factors for all citizens.

VOTE YES ON PROPOSITION A.

A. Cecil Williams, Glide United Methodist Church
Bob Barry, President, S.F. Police Officers Association
William Corvin, President, California Steam Company
J. M. Eaneman, President, AMC Cancer Research Board of Directors
George Foos, Chairman, Great Western Value Centers
Rev. John L. Green, Chaplain, S.F. Fire Department
Albert S. Samuels, Jr., Past President, Market Street Project
Harvey Matthews, Bayview-Hunter's Point Democratic Club
Arthur Goedewaagen, President, Sunset-Parkside Education & Action Committee

ARGUMENT IN FAVOR OF PROPOSITION A

Prior to the Great Earthquake and Fire of 1906, San Francisco Fire Chiefs had always insisted the City was not prepared for a major disaster. History proved them correct. Today, 80 years later, San Francisco's preparation is still not adequate.

When each of us was Chief of Department, we emphasized the need for the additional preparedness necessary to prevent a sweeping fire storm or catastrophic disaster. That state of preparedness has yet to be attained. However, Proposition A offers a once-in-a-life opportunity to protect life and property, through preparation, at an extremely minimal cost. This opportunity should not be missed.

Proposition A will provide the necessary water supplies vital to preventing another conflagration of the 1906 magnitude!

Proposition A will expand the high-pressure firefighting water supply system beyond the commercial areas into the residential neighborhoods!

Proposition A will greatly improve fire defenses not only in the western part of San Francisco but City-wide as well!

Proposition A will ensure that San Francisco is no longer one of the few remaining major cities with a sub-standard Emergency Operations Center for command and control during disasters and earthquakes!

As former San Francisco Fire Chiefs, we urge you to **VOTE "YES" ON PROPOSITION A.**

William F. Murray, Chief, San Francisco Fire Department, Retired
Keith P. Calden, Chief, San Francisco Fire Department, Retired
Andrew C. Casper, Chief, San Francisco Fire Department, Retired

ARGUMENT IN FAVOR OF PROPOSITION A

- Yes on Proposition A.
- Local fire chiefs have warned about grave BART fire catastrophe dangers. End disregard of public safety.

— San Franciscans for BART Safety

ARGUMENT IN FAVOR OF PROPOSITION A

This is a vital issue for San Francisco. **Emergency Water Supplies for Fire Fighting** must be provided throughout the City.

Many fires will occur if a major earthquake strikes San Francisco.

The Fire Department needs a water suply to prevent a conflagration (fire storm) from occurring again, as it did in 1906.

Earthquakes are a geologic fact of life and cannot be prevented, but we can prepare for the fires that will occur, this makes sense for all citizens.

VOTE YES ON PROPOSITION A.

Philip S. Day, Jr.
Director, San Francisco Office of Emergency Services
Richard Eisner, Earthquake Preparedness Consultant
Jelena Pantelic, Chairperson, Disaster Preparedness Committee
Joe Posillico, Emergency Services, Salvation Army
Peter Ashen, Disaster Director, American Red Cross

ARGUMENT IN FAVOR OF PROPOSITION A

San Francisco Council of Civic Organizations endorsements:
Proposition A — YES
Proposition M — YES

Terence Faulkner
President, San Francisco Council of Civic Organizations

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and providing Emergency Water Supplies for Fire Fighting are of vital importance to San Francisco.

VOTE YES ON PROPOSITION A.

Donald J. Birrer, Director of Public Works
Frank M. Jordan, Chief of Police
Dean Macris, Director of Planning
Rudy Nothenberg, General Manager, Public Utilities
William Stead, General Manager, Municipal Railway
David Werdegar, M.D.M.P.H., Director of Public Health
James D. Cooney, General Manager, S.F. Water Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Appendix M

FIRE COMMISSION

City and County of San Francisco

Gavin Newsom, Mayor

Victor Makras, *President*
Stephen A. Nakajo, *Vice President*
George Lau, *Commissioner*
Andrea Evans, *Commissioner*

698 Second Street
San Francisco, CA 94107
Telephone 415.558.3451
Fax 415.558.3413
Monica Quattrin, *Commission Secretary*

SAN FRANCISCO FIRE COMMISSION

RESOLUTION 2010-01

ENCOURAGING THE FIRE DEPARTMENT TO PURSUE GRANT FUNDING IN THE AMOUNT OF $9.785 MILLION FROM THE FEDERAL GOVERNMENT, TO EXPAND THE DEPARTMENT'S PORTABLE WATER SUPPLY SYSTEM.

WHEREAS, The uniformed employees of the San Francisco Fire Department (SFFD) respond to approximately 100,000 incidents a year; and,

WHEREAS, It is the responsibility of the SFFD and its members to protect the lives and property of the citizens of San Francisco from the effects of natural disasters; and,

WHEREAS, The United States Geological Survey has issued increasingly frequent warnings of the high probability of a potentially catastrophic earthquake in the San Francisco Bay Area during the next thirty years; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the spread of fire following earthquakes in modern urban settings, have predicted that there is a high likelihood that San Francisco will be subject to multiple simultaneous conflagrations following a major Bay Area earthquake; and,

WHEREAS, The assessed value of the real estate in San Francisco subject to property taxation exceeds $100 billion; and,

WHEREAS, The spread of fire following earthquakes in a modern urban setting typically is responsible for as much as 75% of the total dollar loss that results; and,

WHEREAS, Loss of life following an earthquake in a modern urban setting is greatly exacerbated by the effects of resultant fires in buildings where occupants have been trapped by structural collapse; and,

WHEREAS, The Auxiliary Water Supply System does not cover the entire geographic areas of the City and County of San Francisco; and,

WHEREAS, The SFFD's Portable Water Supply System has been proven effective in the above-ground transmission of water for fire fighting purposes; and,

WHEREAS, The Portable Water Supply System works in conjunction with and can supplement the existing Auxiliary Water Supply System, and therefore the Portable Water Supply System is capable of partially mitigating the possible lack of domestic water system availability following a major earthquake; and,

WHEREAS, the number of units currently comprising the SFFD's existing Portable Water Supply System is not adequate to supply all areas of San Francisco where the Auxiliary Water Supply System does not extend; and

WHEREAS, the proposed design for expanding the Portable Water Supply System has been shown to be a highly cost effective and functionally adaptable method of providing the means by which firefighters can attack multiple conflagrations simultaneously;

WHEREAS, the SFFD is working with Senator Dianne Feinstein and Speaker of the House Nancy Pelosi in seeking these grant funds, now therefore, be it

RESOLVED, That the Fire Commission encourages the Fire Department to actively pursue grant funds in the amount of $9.785 million from the Federal government, to expand the Portable Water Supply System and train SFFD uniformed members, the Fire Reserve, and other members of the community who may assist the SFFD in times of disaster.

Adopted at the Regular Meeting of the San Francisco Fire Commission on January 14, 2010.

Ayes:	4 (Makras, Nakajo, Lau, Evans)
Nays:	0

Monica Quattrin

Monica Quattrin, Commission Secretary

Appendix N

Frequently Asked Questions - Fire Suppression Water Systems

San Francisco Water
Services of the San Francisco Public Utilities Commission

1) What is the Auxiliary Water Supply System, and what is its primary function?

The Auxiliary Water Supply System (AWSS) is a non-potable fire-suppression water system that was built the decade following the catastrophic 1906 San Francisco earthquake. The purpose of the AWSS is to provide the San Francisco Fire Department (SFFD) with a high-pressure fire suppression water system that can be utilized during large fires. The system is vital for protection against the loss of life, homes, and businesses from fire following an earthquake and non-earthquake multiple-alarm fires.

There are two aspects of the AWSS that are critical to its success:

1. Distribution infrastructure: The AWSS consists of over 135 miles of high-pressure pipeline and hydrants. The system utilizes approximately 30 seismically-reliable motorized valves, allowing the SFPUC to valve off sections of the system, to ensure that pressure is maintained in areas where fires are occurring.
2. The water supply that feeds into the AWSS distribution infrastructure. The primary source of the AWSS is the SFPUC's Hetch Hetchy Water System.

The original AWSS system consisted of three reservoirs and two seawater pumping stations. Their capacities:

- 10.5 million gallon Twin Peaks Reservoir,
- 0.5 million gallon Ashbury Heights Tank, and
- 0.75 million gallon Jones Street Tank.
- Seawater pump station #1: 10,000 GPM (located in SOMA)
- Seawater pump station #2: 10,000 GPM (located near Aquatic Park)

In 2010, the management of the AWSS was transferred to the San Francisco Public Utilities Commission (SFPUC). A shared goal of the SFPUC and SFFD is doing the following to expand and improve the reliability of the water supply serving the AWSS. The agencies have undertaken the following to do so:

- 95% completion of the $4.8 billion Water System Improvement Program (WSIP), providing robust seismic upgrades to the pipelines, reservoirs, and infrastructure that supply water to San Francisco and the greater Bay Area;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;

- Analyzing the usage of the 90 million gallon North Basin of Sunset Reservoir as a water Supply for a Potable AWSS in the Sunset and Richmond Districts; and
- Investigating the installation of a seawater pump station at Ocean Beach to serve as a secondary source of water for fire suppression for the Sunset and Richmond Districts.

In addition to the AWSS, the SFPUC's low-pressure drinking water system and its low-pressure hydrants, as well as approximately 180 cisterns throughout San Francisco, can be pumped and utilized by SFFD Fire Trucks for fire-suppression.

2) Is the AWSS located throughout San Francisco? If not, why?

The AWSS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the central business district and the majority of the city's population at that time.

The San Francisco Public Utilities Commission (SFPUC), SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the SFPUC intends to use the best possible technology available to meet the performance standards of the SFFD. Please standby for future updates to the SFPUC webpage for images, graphics, and maps showcasing the original AWSS system, recent upgrades, and future projects.

3) Who manages the AWSS, the SFPUC or the SFFD? How does the SFFD know that the AWSS system is being adequately and safely maintained?

The SFFD owned and managed the AWSS and the fire hydrants on the potable water system from the early 1900s until 2010. During this time the SFFD collaborated with staff from San Francisco Public Works (SFPW) to implement upgrades to the system. In 2010, the AWSS was transferred to the SFPUC, the City's experts in water supply piping systems. By bringing in the SFPUC to work with SFFD and SFPW, City leaders created an interagency team with all of the expertise needed to manage, operate, and update the AWSS.

The SFFD is considered the end user of the system, and therefore system improvements and expansion completed by SFPUC must meet the rigorous and high-quality standards of the SFFD. The SFFD and SFPUC meet monthly to discuss operations of the AWSS, report on maintenance activities, review capital and developmental project design and status, and communicate on policies and procedures that affect both departments.

This partnership presents the best of both worlds for San Franciscans. The women and men of SFFD are internationally-recognized for their expertise, experience, and bravery in fighting fires. Similarly, the SFPUC, with its Hetch Hetchy Water System, is recognized as one of the top water agencies in the world. The SFPUC has hundreds of engineers that are experts in designing, expanding, and improving water systems. Additionally, the SFPUC has over 80 plumbers and dozens of construction management experts in-house that are dedicated to providing high-quality maintenance and oversight of the construction projects needed to keep the AWSS functioning for the SFFD's use.

With the two agencies working together, in partnership with SFPW, the City of San Francisco has the experts it needs to successfully operate, expand, and improve the AWSS.

4) What are the SFPUC and SFFD doing to increase fire protection in the areas of the City that do not have the AWSS?

When the SFPUC took over control of the system, the agency worked with SFFD to complete a review of all existing facilities and a comprehensive Planning Study.

The analysis modeled the hydraulic reliability of the existing AWSS after a major earthquake. In this context of this study, hydraulic reliability is defined as the percentage of the water needed by SFFD to fight fires that would be met by the AWSS and other sources after a 7.8 earthquake on the San Andreas Fault.

Our analysis showed that the 2010 AWSS was 47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake. Utilizing this information, the SFPUC, SFFD, and SFPW identified projects that would increase system reliability and could be funded by the 2010 and 2014 Earthquake Safety and Emergency Response (ESER) Bonds authorized by San Francisco voters. Decisions on which projects to implement utilizing bond funds are based on a given project's ability to improve the reliability score for the Fire Response Area that the given project serves and to increase the likelihood of delivering water after an earthquake.

Bond-funded projects make seismic upgrades to the system and repair, replace, and extend system components to increase the ability to provide adequate water for firefighting. Funding is allocated to repair, replace, and extend system components to improve the ability to provide adequate water for firefighting purposes following a major earthquake and during multiple-alarm fires from other causes. This includes repairs and upgrades to core facilities, pipelines, and tunnels, and construction of new cisterns.

The following projects have been completed utilizing the funds from the 2010 and 2014 bonds:

- Installation of 30 new cisterns (with 15 of these cisterns installed in the Sunset and Richmond districts);
- Reliability upgrades at the three primary source supplies – Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- 6 pipeline and tunnel projects.

The following projects are in construction and/or design phase:

- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- 16 pipeline and tunnel projects;
- Motorizing critical seismically-reliable valves for remote control, and improving the electronic control system of the valves; and
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;
- Preliminary analysis for a Potable AWSS for the Sunset and Richmond Districts. *Additional information on that system can be found in questions 6-11.*

Once fully completed, the projects implemented with the ESER 2010 bond funds will increase the citywide reliability score from 47% to 67%. The full completion of the projects implemented with the ESER 2014 bond funds will increase the citywide reliability score from 67% to 87%. Construction of additional recommended future projects will increase the citywide reliability score to 96%.

5) Who makes decisions on the selection and implementation of AWSS projects? Who reviews the progress and implementation of AWSS capital projects?

Overseeing the selection and implementation of AWSS projects is the Management Oversight Committee consisting of SFPUC General Manager Harlan Kelly, SFFD Chief Joanne Hayes-White, SFPW Director Mohammed Nuru, and SFPUC Assistant General Manager of Water Steve Ritchie.

The San Francisco Capital Planning Committee, consisting of the City Administrator and including the President of the Board of Supervisors, the Mayor's Budget Director, the Controller, the City Planning Director, the Director of Public Works, the Airport Director, the Executive Director of the Municipal Transportation Agency, the General Manager of the Public Utilities System, the General Manager of the Recreation and Parks Department, and the Executive Director of the Port of San Francisco, reviews the progress and implementation of AWSS capital projects. Capital Planning Committee meetings are open to the public. Please find more info at the Committee's webpage.

6) Are the SFPUC and SFFD looking at something called a Potable AWSS for fire suppression on the Westside of San Francisco. What is a Potable AWSS? How does it function? How is it different from the existing AWSS?

The word "potable" is defined as "safe to drink". The Potable AWSS currently under analysis will connect to the 90 million gallon North Basin of the Sunset Reservoir, and will provide a high-pressure firefighting system for the SFFD to fight fires in the Richmond and Sunset Districts. **The Potable AWSS will meet the same rigorous standards required by SFFD to fight large fires, and will utilize the same earthquake resistant pipes, seismically-reliable valves, hydrants, and components utilized by the AWSS, and therefore will be designed to function at the high-pressure level required by SFFD.** The Potable AWSS project is currently in the planning and analysis phase. The SFPUC will work with SFFD to design the system with operational capabilities and design criteria standards equal to or exceeding the existing AWSS.

The Potable AWSS will also have roughly 5 connections to potable water pipes in the Sunset and Richmond districts. **These connections will utilize the same valves as the 30 valves the existing AWSS currently uses to isolate sections of the AWSS to maintain system pressure.** Additionally, these 5 valves will be tested at the same schedule as the existing valves to ensure their performance during an incident. During non-fire events, the Potable AWSS pipeline will be one of many pipes supplying drinking water to the Richmond and Sunset districts.

In the event of a major fire, the approximately five isolation valves will be closed automatically, remotely, or manually, which are the same methods that the 30 valves on the existing AWSS utilize. These five isolation valves will be closed so that the Potable AWSS will be disconnected from the City's low-pressure water system and therefore can provide reliable high-pressure water for fire-fighting. If the Potable AWSS is isolated for firefighting use, homes and businesses will continue to be served by other redundant low-pressure drinking water distribution pipes, assuming that those low-pressure pipes have not incurred numerous breaks and leaks during the earthquake.

An additional benefit of the Potable AWSS is that it will be designed and constructed to meet required AWSS performance standards, and the system will be rated to meet drinking water standards. This means that after firefighting following an earthquake, the Potable AWSS will be able to provide drinking water to the Sunset and Richmond Districts even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

7) Does the Potable AWSS provide an equivalent amount of fire suppression when compared to the existing AWSS? Can the Potable AWSS provide the water pressure and supply of water needed by SFFD to fight small and large fires?

Yes. The Potable AWSS will be designed to meet all SFFD performance requirements. The SFFD will not reduce or lower their robust performance standards, and therefore the SFPUC must design, construct, maintain, and operate the Potable AWSS system to meet these standards. The SFPUC is currently working in conjunction with SFFD to design a system that will have pressure and performance capabilities equal to or exceeding AWSS.

8) Does the Potable AWSS use the same type of earthquake resistant piping and valves as the AWSS?

Yes. The Potable AWSS will use earthquake resistant piping that is equal or better than the current AWSS piping design standard. Additionally, the Potable AWSS will utilize the same seismically-reliable valves as the 30 existing valves currently utilized by the AWSS to isolate sections of the system to ensure supply reliability in areas with fires. The hydrants utilized will also be the same as the existing AWSS. All of these components will be able to property function at the high-pressure levels required by SFFD.

9) The Potable AWSS relies on automatic valves to boost the water pressure to the level needed to fight big fires. What if the automatic valves fail, will SFFD be without the water they need to fight big fires? Does the existing AWSS rely on these automatic valves to fight fires? Does the Potable AWSS rely on more of these valves than the existing AWSS?

The potable AWSS will be isolated after an earthquake from the remainder of the distribution system by seismically-reliable motorized valves using the same method and equipment as current AWSS valves. All valves, future and existing, have redundant safeguards and a maintenance program that will ensure their performance. The valves can be operated manually if the valve actuators fail, just like the existing AWSS motorized valves. The valves are utilized by the existing AWSS and the future Potable AWSS to isolate sections of pipe to ensure that the systems provide the water supply and pressure needed by SFFD to fight big fires.

The quantity of the motorized valves on the future Potable AWSS will be dependent on the length of the Potable AWSS pipeline constructed, but is anticipated to be approximately 5 valves.

10) Are there other cities that have implemented a Potable AWSS? Or do other cities utilize systems similar to the existing AWSS?

Only one other city in the world, Vancouver, B.C. Canada, has been identified as having an isolated secondary firefighting system similar to the existing AWSS. Vancouver's system is less than 10 miles in length, while ours has over 135 miles.

To our knowledge, all other cities rely on their low-pressure potable water system and hydrants for fire-fighting. In Japan, a country that has similar seismic risk to that of San Francisco, cities utilize a system similar to the proposed Potable AWSS. The Japanese system is designed similar to our proposed Potable AWSS – for fighting a large fire after an earthquake, seismically-reliable water transmission mains and hydrants are isolated from the rest of the distribution system using seismically-reliable valves. This allows the Japanese's seismically reliable mains to be increased in pressure and used for fire-fighting. After the fires are suppressed, the Japanese system is used to provide drinking water to residents and businesses.

Recently a team of Japanese water engineers came to San Francisco to showcase the success of their piping system and their experience using Kubota pipes to SFPUC and SFFD staff. The Japanese team highlighted the success of their system and its piping in its utilization after earthquakes to fight fires.

Japan's successful implementation and use of a system similar to the proposed Potable AWSS showcases that the approach and technology do work in fighting fires after a major earthquake.

The North and South Basins have a combined capacity of 176 million gallons. The North Basin, with a capacity of 90 million gallons, will be connected to the Potable AWSS. The North Basin recently underwent a $64 million seismic upgrade, and is designed to withstand a 7.9 San Andreas Fault earthquake. It can be isolated from the South Basin, and therefore all 90 million gallons could be used for firefighting purposes.

If firefighting requires a flow of 14,000 gallons per minute for the Sunset and Richmond districts, the 90 million gallon water supply in the North Basin of Sunset Reservoir will last for 4.5 days. This assumes that no additional water is added from the Hetch Hetchy Water System, which is **very** unlikely. Please see question #12 for additional info.

During an emergency situation, the South basin of Sunset Reservoir will be isolated from the North Basin, allowing the North Basin to be used solely for firefighting purposes. The 86 million gallon South Basin will still be connected to the City's low-pressure drinking water distribution piping system so that residents and businesses can receive drinking water while fires are being fought. In an Earthquake situation, residents and businesses may not receive continuous drinking water from the South Basin as fires are being fought, if there are breaks and/or leaks in the low-pressure drinking water pipes that connect to the South Basin. After the fires are put out, the Potable AWSS, connected to the North Basin, will be able to provide drinking water to the Sunset and Richmond Districts, even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

In 2008, seismic improvements to the North Basin of Sunset Reservoir were completed for $64 million under the SFPUC's Water System Improvement Program (WSIP). Also under the WSIP, seismic improvements were made on the pipelines leading to Sunset Reservoir. **Thus, it is anticipated that the reservoir can be replenished from the Hetch Hetchy Water System within 24 hours of a major seismic event. Therefore, the Hetch Hetchy Water System will be able to re-fill the North Basin of the Sunset Reservoir prior to the Potable AWSS draining it after 4.5 days of use.**

The Hetch Hetchy Water System consists of 9 reservoirs, capable of supplying up to 265 million gallons of water per day. The WSIP includes $4.8 billion in upgrades to the system, increasing its seismic reliability and ability to provide water to the Bay Area after a large earthquake.

The primary water source for the existing AWSS is the 10 million gallon Twin Peaks Reservoir, 0.5 million gallon Ashbury Heights Tank, and 0.75 million gallon Jones Street Tank. As part of the AWSS bond-funded projects, the Summit Reservoir, with its 11 million gallons of storage, can now be better used by the AWSS. This reservoir serves as a back-up, and would only be utilized by the AWSS during a large fire.

If additional water sources are needed, there are 2 seawater pump stations on the east side of San Francisco that can be utilized to supply a back-up water supply to the AWSS. There have been no known uses of these 2 stations during a fire since their installation in the early 1900s.

The Sunset Reservoir North Basin, with its large capacity and seismic reliability, provides an excellent, existing supply that can be used for the proposed Potable AWSS at no additional cost to rate payers. This reservoir is nine times larger than the existing Twin Peaks reservoir, the primary source utilized by the AWSS.

In the future, an existing SFPUC pump station at Lake Merced will be modified to pump Lake Merced water into new AWSS pipelines that will be installed by the Park Merced development project. Eventually, the Park Merced AWSS pipeline could be connected to the existing AWSS pipeline near Ocean Avenue. Current work will connect the 140 million gallon University Mound Reservoir to the existing AWSS.

The SFPUC is also analyzing new seawater pump stations that could be developed along Ocean Beach and by Hunters Point Shipyard, and will provide updates to the public as the analysis is completed. These future pump stations could serve as back-up supplies for the AWSS and Potable AWSS. Please note that the Potable AWSS would have to be converted to an AWSS if seawater was used, which would cause the system to lose the benefit of being a seismically reliable potable water distribution system for the Sunset and Richmond Districts.

16) How long will it take to install the Potable AWSS in the Sunset and Richmond District? I want fire suppression in the Westside of San Francisco ASAP.

The Potable AWSS is in the planning phase. Pipeline construction could begin in 2019 if the Management Oversite Committee gives direction to proceed with this project. SFPUC is requesting approval for funding of one mile of pipeline per year at $10 million per mile. Depending on the final length of Potable AWSS pipeline, the construction could be completed in four to eight years. A four-mile pipeline would take four years, while an eight-mile pipeline would take eight years. Each mile of pipeline installed provides significantly greater firefighting protection.

Please note that because the Potable AWSS option provides potable water benefits to the Sunset and Richmond Districts, bond funding **and** SFPUC rate payer funds could be used to pay for its implementation.

The same is not true if a traditional AWSS is deployed in the Sunset and Richmond Districts. Traditional AWSS systems can only utilize bond funding. Due to this distinction, a traditional AWSS would likely have a longer implementation timeline than a Potable AWSS because there is not enough bond funding in place to complete a traditional AWSS at this time. A Potable AWSS project could begin implementation more quickly using SFPUC rate payer funds.

18) How do population growth and new buildings affect firefighting reliability, and will AWSS be expanded to growing areas of San Francisco, such as new development areas in the east and southeast areas of San Francisco?

As new developments and population growth occur in San Francisco, the water required for firefighting to address post-earthquake fires may change. SFPUC is modelling the effects of new developments on AWSS capacity requirements, both within the new developments and in the City as a whole. The SFPUC and SFFD are working together to specify new AWSS piping and hydrants required within the new developments. Additionally, developers are required to contribute financing towards, or construct, AWSS facilities such as pipelines or pump stations, for additional firefighting needs. These requirements are specified in the Development Agreements approved by the Board of Supervisors for new, large development projects.

Appendix O

Project Name	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract
Cisterns	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**30**	**30**	
Physical Plant	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**4**	**10**	
Ashbury Tank									1		
Jones Street Tank									1		
Lake Merced Pumping Station - conventional AWSS	1										
Lake Merced Pumping Station - potable AWSS	1										
Pumping Station 1				1							
Pumping Station 2				1							
Twin Peaks Reservoir									1		
Twin Peaks Reservoir Joint Sealing									1		
Sunset Reservoir Pumping Station - potable AWSS	1										
University Mound Pumping Station - conventional AWSS								1			
Pipelines & Tunnels	**1**	**2**	**2**	**3**	**0**	**0**	**5**	**6**	**9**	**28**	
4th Street Connection							1				
Clarendon Supply			1								
Control System									1		
Fillmore & Haight								1			✓
Fort Mason Pier 2 Seawater Manifold								1			
Jones Street Tank Valves									1		
Pipeline Repairs									1		
Planning Study (CS-199)									1		
Pumping Station 1 Tunnel								1			
Seawater Fireboat Manifolds Evaluation									1		
Seawater Suction Connections									1		
Street Valve Motorization								1			
Twin Peaks Reservoir 16" Supply									1		
19th Avenue Pipeline			1								✓
Ashbury Bypass Pipeline				1							✓
Candlestick Point - Carroll Avenue									1		
Columbus & Green Pipeline									1		✓
FWSS - Lake Merced							1				
FWSS - McLaren Park Tanks							1				
FWSS - Street Crossings							1				
FWSS - Sunset Reservoir							1				
Ingleside Pipeline								1			
Irving Street Pipeline				1							✓
Lake Merced Pipeline		1									
Mariposa TFB Pipeline				1							
TFB Mission Rock - South Pipeline		1									
Westside Potable AWSS Pipeline	1										
University Mound East Pipeline								1			
Assessments	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**12**	
Ashbury Heights Valve House Evaluation									1		
Jones Street Tank Generator Foundation Evaluation									1		
Jones Street Tank Retaining Walls Assessment									1		
Jones Street Tank Valve House Evaluation									1		
ESER 2014 Project Recommendations									1		
Pipeline Network Surge Analysis									1		
Pumping Station 1 Foundation & Well Evaluation									1		
Pumping Station 1 Tunnel Evaluation (PS1 to bay)									1		
Pumping Station 2 Discharge Tunnels Evaluation									1		
Pumping Station 2 Well Evaluation									1		
Twin Peaks Reservoir Forebays Evaluation									1		
Twin Peaks Reservoir Tunnel Evaluation									1		
	4	2	2	5	0	0	5	7	55	80	
	Planning	**Design**	**Procurement or Bid/Award**	**Construction**	**Substantial Completion**	**Final Completion**	**Cancelled**	**Postponed**	**Complete**	**Total**	**SFPW Construction Contract**

Appendix P

Candidate EFWS Projects

5/8/2019

Projects	Project Cost ($M) (2018 $)	No. of FRA's Directly Benefited	Hydraulic Power (MW)	Project Cost/MW ($M)	Scaling Factor to Lowest $/MW
Pipeline Projects					
1 Conv. AWSS PL - Diamond Street	4	1	0.7	6	1.0
2 Westside Seawater Supply PL			TBD		
3 Conv. AWSS PL - Lake Merced	4	1	0.1	25	4.2
4 Conv. AWSS PL - College Hill Supply	34	0	0.8	43	7.1
5 PEFWS	195	8	4.1	44	7.3
6 Conv. AWSS PL - Ingleside (Phase 1)	6	1	0.1	53	8.8
7 Conv. AWSS PL - Stanford Heights Supply	18	0	0.3	60	10.1
8 Conv. AWSS PL - University Mound East	23	4	0.4	67	11.2
9 Conv. AWSS PL - Ingleside (Phase 2)	14	1	0.2	78	13.0
10 Conv. AWSS PL - University Mound West	19	2	0.2	112	18.7
Subtotal Pipeline Projects	**317**		**6.8**		
Supply Projects					
1 Potable EFWS - Lake Merced PS	40	8	4.6	9	1.3
2 Conv. AWSS Lake Merced PS	10	2	1.5	7	1.0
3 Potable EFWS - Sunset PS	34	8	4.6	7	1.1
4 Conv. AWSS University Mound PS	20	10	2.6	8	1.2
5 Conv. AWSS Manifold - Pier 33-1/2	5	0	0.4	13	1.9
6 PS1 Well	2	0	0.1	13	2.1
7 Westside Seawater PS			TBD		
8 Conv. AWSS Manifold - Fort Mason Pier 1	8	0	0.4	21	3.1
9 Conv. AWSS College Hill Supply PS	25	0	1.0	25	3.8
10 Twin Peaks Forebays	6	0	0.2	26	3.9
11 Twin Peaks Tunnel	8	0	0.2	34	5.2
12 PS1 Tunnel (Phases 1 and 2)	13	0	0.3	43	6.6
13 Conv. AWSS Stanford Heights Supply PS	26	0	0.6	43	6.6
14 PS2 Discharge Tunnels	5	0	0.1	67	10.3
15 PS2 Well	4	0	0.04	89	13.7
Subtotal Supply Projects	**206**		**16.8**		
Infirm Zone Projects					
1 Conv. AWSS PLs - Infirm Zone 7	16	1	0.21	79	1.0
2 Conv. AWSS PLs - Infirm Zone 9	10	1	0.03	320	4.1
3 Conv. AWSS PLs - Infirm Zone 3, 4, 5	33	3	0.05	666	8.5
4 Conv. AWSS PLs - Infirm Zone 1, 2	32	2	0.04	790	10.1
5 Conv. AWSS PLs - Infirm Zone 6	18	1	0.00		
6 Conv. AWSS PLs - Infirm Zone 8	7	1	0.00		
7 Conv. AWSS PLs - Infirm Zone 10	19	1	0.00		
Subtotal Infirm Zone Projects	**135**		**0.3**		
Other Projects					
1 Conv. AWSS PL - PIPE - Bryant & 11th	16	0	0.15	104	1
2 Conv. AWSS PL - PIPE - Dolores & 20th	9	0	0.05	197	1.9
3 Conv. AWSS PL - PIPE - Brannan St.	36	0	0.04	953	9.2
4 Conv. AWSS PL - PIPE - Market St.	28	0	0.03	871	8.4
5 Ashbury Valve House	5	0			
6 Jones St Generator Foundation	1	0			
7 Jones St Valve House	5	0			
8 PS2 Remote Operation and Engine Repl.	12	0			
9 Miscellaneous Repairs	15	0			
10 Conv. AWSS PL - Surge Protection	4	0			
11 Conv. AWSS PL - Valve Renovation	6	0			
Subtotal Other Projects	**136**		**0.3**		
Development Projects					
1 Potrero PL	14	1			
2 Southern Area Supply Projects	166	5			
Subtotal Development Projects	**180**				
Grand Total	**974**		**19**		

1) MW=Hydraulic power (MW)
(1 MW = 1,341 hp)
2) S=Scaling factor to lowest $/MW

Appendix Q

Fire Dept.'s Ace in the Hole

By Jim Castleberry

The night of the Oct. 17 earthquake was not the first time the San Francisco Fire Department had to call on its Portable Water Supply System, but it was by far the most important.

When firefighters responded to a blaze in the Marina District, they were horrified to learn that *all the water lines in a 40 square block area surrounding the fire were broken and useless.*

With no water pressure, firefighters could only watch as the fire raged out of control and threatened to explode into the largest blaze in the city since 1906.

But the city had one more card to play – its ace in the hole.

Division Chief Harry Brophy issued the call for the Fireboat Phoenix and the department's Portable Water Supply System (PWSS).

For Assistant Chief Frank Blackburn, who developed the PWSS, and his fellow firefighters, it was the test they had been waiting for. The one that would determine once and for all if the PWSS, hailed as ingenious by some and a boondoggle by others, really worked. "I told the guys that this was the Super Bowl," Blackburn said.

Fortunately for the city, the PWSS performed perfectly.

As the Phoenix pumped water from the Bay, firefighters set up portable hydrants on Divisadero Street that allowed them to stretch hoses all the way to the fire at Beach Street.

Within an hour after the system was hooked up, the fire had been brought under control.

San Francisco's Board of Supervisors rewarded Blackburn with a commendation, thanking him not only for the development of the system but his quick work in putting it to use on Oct. 17.

"Without those portable hydrants, along with the fireboat, the city probably would have burned to the ground," Supervisor Terrance Hallinan said. "Blackburn knew where all the hydrants were and as soon as it hit, he rounded them up and set them into operation. It was a key to turning that whole situation around."

The key to the PWSS is the portable hydrant designed by Blackburn from old Gleeson pressure-reducing valves and other spare parts lying around the department's repair shop.

Using the hydrants, firefighters can pump from the Bay, a lake or underground cistern and lay a grid of hose covering several blocks.

The portable hydrants not only allow water pressure to be maintained, they also let firefighters hook up pumper trucks or fire hoses along the line so fires in multiple locations can be battled.

"Say there was a fire on Van Ness Avenue and all the water mains were broken," Blackburn said. "The PWSS would let you pump water from the Bay, all the way up Van Ness. People say it can't work, but it does. We proved it on Oct. 17."

Blackburn didn't start working on the portable hydrants and PWSS until 1984. By 1985 a prototype was ready and they were in regular use by 1986.

The PWSS helped put out a five alarm fire at First and Townsend street in 1987 and was also used at Hetch Hetchy later that year to protect buildings threatened by a fire burning in Yosemite National Forest.

"We drafted water from the Tuolumne River for that one," Blackburn said. "It's amazing. All you need is a body of water."

"It's something that San Francisco should really be proud of," said Dr. Charles Scawthorn, a researcher who has done extensive study of the risk posed to San Francisco by fire.

In 1987 Scawthorn wrote a report for the insurance industry on the conflagration risk in San Francisco following a major earthquake similar to 1906.

His report foresees widespread destruction with billions of dollars in property losses and dozens of major fires – similar in size to the Marina fire – after a magnitude 8.3 or larger quake.

"Everything that happened on Oct. 17 confirmed my findings," he said. "But the PWSS is obviously going to greatly improve the chance of the city surviving 'The Big One.' It won't save it entirely but at least we'll be able to limit the losses."

The Portable Water Supply System includes:

-- Four hose wagons that carry 4,000 to 5,000 feet of large, five inch diameter hose that connect to the portable hydrants (normal firehose is only three inches in diameter.

-- Underground cisterns located throughout the northern and eastern sections of the city that can be filled with water to supply trucks along the way.

-- Portable hydrants that allow water to flow freely for long distances at a very high pressure.

Scawthorn recommends a large-scale expansion of the PWSS.

"If there are only four hose wagons, you can only fight fires in four locations," Scawthorn said. "After a big quake there will be fires breaking out all over the city."

The Fire Commission has indicated its desire to expand the system and cleared the way for building of more cisterns in the outer Sunset and Richmond residential neighborhoods.

Plans are also underway to purchase more large-diameter hose, if the money can be found.

Blackburn calls it the best defense a city like San Francisco can have against fire following an earthquake.

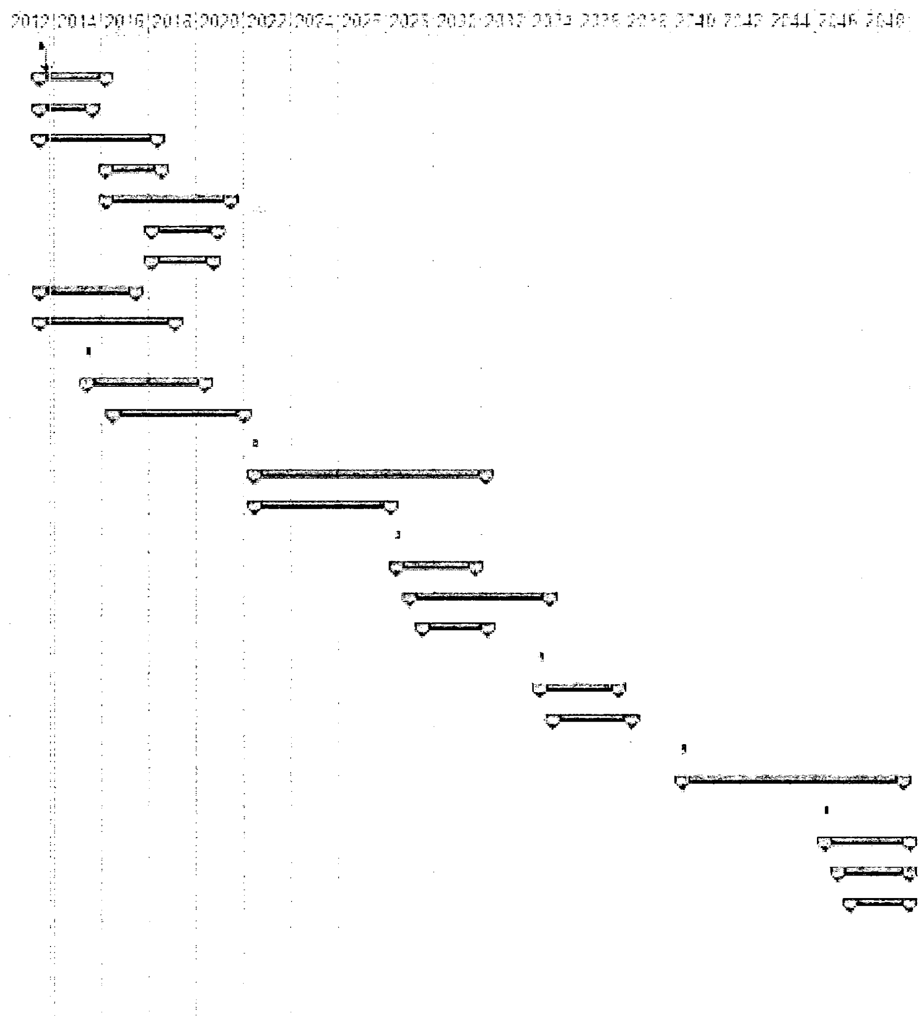
"When a major quake occurs and water mains are broken, the answer is the PWSS," he said. If you don't have it, you won't put the fires out."

1990 article on the Portable Water Supply System, an adjunct to the AWSS, and its use during the post-earthquake fires in October 1989.

Appendix R

Figure 5-1. Preferred Alternative Planning Level Schedule

ID	Task Name	Duration	Start	Finish
1	Alternative E	1 day	Mon 6/3/13	Mon 6/3/13
2	Motorization & addition of seism	720 days	Tue 6/4/13	Mon 3/7/16
[illegible]	4th Street Hose	576 days	Tue 6/4/13	Tue 8/18/15
[illegible]	PS1 Tunnel upgrade	1296 days	Tue 6/4/13	Tue 5/22/18
[illegible]	Jones St. Tank Bypass Valves	624 days	Tue 3/8/16	Fri 7/27/18
[illegible]	Repair suction connections	1372 days	Tue 3/8/16	Wed 6/9/21
[illegible]	SCADA improvements	720 days	Fri 2/16/18	Thu 11/19/20
[illegible]	FB Manifold R&R	672 days	Fri 2/16/18	Mon 9/14/20
[illegible]	Pipe Investigation and Repair	1050 days	Tue 6/4/13	Mon 6/12/17
[illegible]	Sutro Connection and PS	1400 days	Tue 6/4/13	[illegible]
[illegible]	2014 Bond	1 day?	Mon 6/1/15	Mon 6/1/15
[illegible]	Reliability Upgrades at Facilities	1296 days	Tue 6/2/15	Tue 5/19/20
[illegible]	Cistern Construct 46 New Cister	1432 days	Fri 7/8/16	Mon 1/3/22
[illegible]	2021 Bond	1 day?	Wed 6/1/22	Wed 6/1/22
[illegible]	Pipeline Replacement Program	2548 days	Thu 6/2/22	Mon 3/8/32
[illegible]	Silver Extension	1638 days	Thu 6/2/22	Mon 3/13/28
[illegible]	2027 Bond	1 day?	Thu 6/1/28	Thu 6/1/28
[illegible]	University Mound Connection an	864 days	Fri 6/2/28	Wed 9/24/31
[illegible]	Sunset Extension	1528 days	Thu 12/21/28	Mon 10/30/34
[illegible]	Sunset Rezoning	738 days	Wed 7/11/29	Fri 3/26/32
[illegible]	2033 Bond	1 day?	Thu 6/1/34	Thu 6/1/34
[illegible]	Lake Merced Pump Station	854 days	Fri 6/2/34	Wed 9/23/37
[illegible]	Sunset Connection and PS	854 days	Thu 12/21/34	Tue 4/13/38
[illegible]	2039 Bond	1 day?	Fri 6/1/40	Fri 6/1/40
[illegible]	Pipeline Replacement Program	2432 days	Mon 6/4/40	Tue 9/28/49
[illegible]	2045 Bond	1 day?	Fri 6/1/46	Fri 6/1/46
[illegible]	Richmond Extension	935 days	Mon 6/4/46	Fri 12/31/49
[illegible]	Alemany Extension	791 days	Fri 12/21/46	Fri 12/31/49
[illegible]	Geneva Extension	647 days	Thu 7/11/47	Fri 12/31/49



Carroll, John (BOS)

From: Carroll, John (BOS)
Sent: Thursday, July 25, 2019 3:49 PM
To: BOS-Supervisors
Cc: BOS-Legislative Aides; 'Calvillo, Angela (angela.calvillo@sfgov.org)'; Somera, Alisa (BOS); Civil Grand Jury; Kittler, Sophia (MYR); Karunaratne, Kanishka (MYR); Power, Andres (MYR); Ma, Sally (MYR); Peacock, Rebecca (MYR); Rosenfield, Ben (CON); Rydstrom, Todd (CON); Stevenson, Peg (CON); Lediju, Tonia (CON); Newman, Debra; Campbell, Severin (BUD); Holober, Reuben (BUD); Millman Tell, Jennifer (BUD); Rasha Harvey; Lori Campbell; Kelly, Naomi (ADM); Khaw, Lynn (ADM); Strong, Brian (ADM); Raphael, Deborah (ENV); Gallotta, Peter (ENV); Sheehan, Charles (ENV); Nicholson, Jeanine (FIR); Ludwig, Theresa (FIR); Nakajo, Stephen (FIR); Conefrey, Maureen (FIR); Kelly, Jr, Harlan (PUC); Ellis, Juliet (PUC); Scarpulla, John; Whitmore, Christopher (PUC); Caen, Ann Moller (PUC); Hood, Donna (PUC); Mchugh, Eileen (BOS); GIVNER, JON (CAT)
Subject: 2018-2019 Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Categories: 190786, 190785

Supervisors:

Please find linked below the 2018-2019 Civil Grand Jury report, entitled: **Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System,** as well as a press release memo from the Civil Grand Jury and an informational memo from the Clerk of the Board.

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

Civil Grand Jury Press Release - July 17, 2019

Clerk of the Board Memo - July 24, 2019

I invite you to review the entire matter on our Legislative Research Center by following the link below:

Board of Supervisors File No. 190785

Thank you,

John Carroll
Assistant Clerk
Board of Supervisors
San Francisco City Hall, Room 244
San Francisco, CA 94102
(415) 554-4445

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

MEMORANDUM

Date: July 24, 2019

To: Honorable Members, Board of Supervisors

From: Angela Calvillo, Clerk of the Board

Subject: 2018-2019 CIVIL GRAND JURY REPORT - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 17, 2019, the 2018-2019 Civil Grand Jury issued a press release, publicly announcing issuance of their report, entitled:

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 18, 2019, the Civil Grand Jury issued an updated report, including appendices which we inadvertently omitted from the July 17 public release.

Pursuant to California Penal Code, Sections 933 and 933.05, the Board must:

1. Respond to the report within 90 days of receipt, or no later than October 15, 2019; and
2. For each finding the Department response shall:
   - agree with the finding; or
   - disagree with the finding, wholly or partially, and explain why.
3. For each recommendation the Department shall report that:
   - the recommendation has been implemented, with a summary of how it was implemented;
   - the recommendation has not been, but will be, implemented in the future, with a timeframe for implementation;
   - the recommendation requires further analysis, with an explanation of the scope of the analysis and timeframe of no more than six months from the date of release; or
   - the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Pursuant to San Francisco Administrative Code, Section 2.10, in coordination with the Committee Chair, the Clerk will schedule a public hearing before the Government Audit and Oversight Committee to allow the Board the necessary time to review and formally respond to the findings and recommendations.

Continues on following page

The Budget and Legislative Analyst will prepare a resolution, outlining the findings and recommendations for the Committee's consideration, to be heard at the same time as the hearing on the report. These matters are anticipated for hearing in Government Audit and Oversight during a regular committee meeting in September 2019.

If you have any questions, please contact John Carroll, Assistant Clerk, at (415) 554 4445.

Attachments: July 17, 2019 Press Release; and
July 18, 2019 Updated Report: Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

FOR IMMEDIATE RELEASE

Contacts: Rasha Harvey, Foreperson, 415-716-8258
Stephen Garber, Committee Chairperson, 510-682-4693

***** PRESS RELEASE *****

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR EMERGENCY FIREFIGHTING WATER SYSTEM

San Francisco, CA, July 17, 2019 – San Francisco is notoriously vulnerable to fires following a major earthquake. Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system -- that provides excellent firefighting protection to parts of the City. However, the Civil Grand Jury found that large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS, and would be particularly vulnerable to fire damage when the next major earthquake strikes.

City leaders have known about this deficiency for decades, but have yet to develop concrete plans or a timeline to provide a robust emergency firefighting water supply for all neighborhoods. In 2014, the US Geological Survey estimated that there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043. Plans to develop a seismically safe high-pressure AWSS for the western portion of the City are now moving forward. However, at the City's current pace and funding levels, expansion of AWSS protections to inadequately protected neighborhoods will not be completed for 35 years or more – well after the USGS predicts that one or more major earthquakes will strike. The Civil Grand Jury, therefore, recommends that, by the end of 2020, the City present a detailed plan to extend AWSS protections to all neighborhoods, with an accelerated completion date of no later than 2034.

As an interim measure, the Grand Jury strongly recommends that the Mayor and the Board of Supervisors approve the San Francisco Fire Department's (SFFD) request to replace and expand its portable water supply system (PWSS). Comprised of specially equipped trucks ("hose tenders"), the PWSS can distribute pressurized water from many sources for long distances, and can be built and operational in one to two years. The Grand Jury recommends that these new PWSS hose tenders be strategically placed in Districts 1, 4, 7, and 11 -- neighborhoods lacking in AWSS protections. Although the Mayor's draft budget includes funds for 4 new hose tenders, this is barely sufficient to replace the current inventory of 5 tenders, all of which are past their useful lives.

The Grand Jury also recommends that the San Francisco Public Utilities Commission and the SFFD jointly develop "best practices" to ensure the proper maintenance of all AWSS assets, and that these agencies adopt and implement annual emergency response exercises, which include simulated earthquake drills using both AWSS and PWSS assets.

ACT NOW BEFORE IT IS TOO LATE

Experts tell us that San Francisco is overdue for another major earthquake like the one that devastated the City in 1906. Nevertheless, City officials have not prioritized plans to expand the high-pressure emergency firefighting water supply to all neighborhoods. This is a problem that threatens the lives and property of over one-third of our City's residents. City officials should make the expansion of emergency firefighting protections to all San Franciscans a matter of high priority, before it is too late.

Civil Grand Jury reports may be viewed online at http://civilgrandjury.sfgov.org/report.html.

###

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]			

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]		

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Angela Calvillo
Clerk of the San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Calvillo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Budget and Legislative Analyst
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Sir or Madam,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Sandra Lee Fewer
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Fewer,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

400 McAllister Street, Room 008, San Francisco, CA 94102-4512 • (415) 551-3635 • http://civilgrandjury.sfgov.org/

July 15, 2019

Catherine Stefani
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Stefani,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RH

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Aaron Peskin
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Peskin,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Gordon Mar
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mar,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Vallie Brown
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Brown,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Matt Haney
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Haney,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Norman Yee
President
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear President Yee,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Rafael Mandelman
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mandelman,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Hillary Ronen
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Ronen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Shamann Walton
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Walton,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ahsha Safai
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Safai,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

RH

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Naomi M. Kelly
City Administrator
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Brian Strong
Chief Resilience Officer
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mr. Strong,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Debbie Raphael
Director
San Francisco Department of the Environment
1455 Market Street, Suite 1200
San Francisco, CA 94103

Dear Ms. Raphael,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

R H

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Jeanine Nicholson
Fire Chief
San Francisco Fire Department
698 Second Street
San Francisco, CA 94107

Dear Chief Nicholson,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

400 McAllister Street, Room 008, San Francisco, CA 94102-4512 ∘ (415) 551-3635 ∘ http://civilgrandjury.sfgov.org/

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Stephen Nakajo
President
San Francisco Fire Commission
1765 Sutter Street
San Francisco, CA 94115

Dear President Nakajo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

The Honorable London Breed
Mayor of San Francisco
City Hall, Room 200
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mayor Breed,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Harlan L. Kelly, Jr.
General Manager
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear General Manager Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ann Moller Caen
President
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear President Caen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

Print Form

Introduction Form

By a Member of the Board of Supervisors or the Mayor

Time stamp
or meeting date

I hereby submit the following item for introduction (select only one):

- ☐ 1. For reference to Committee. (An Ordinance, Resolution, Motion, or Charter Amendment)
- ☐ 2. Request for next printed agenda Without Reference to Committee.
- ☒ 3. Request for hearing on a subject matter at Committee.
- ☐ 4. Request for letter beginning "Supervisor [ ] inquires"
- ☐ 5. City Attorney request.
- ☐ 6. Call File No. [ ] from Committee.
- ☐ 7. Budget Analyst request (attach written motion).
- ☐ 8. Substitute Legislation File No. [ ]
- ☐ 9. Reactivate File No. [ ]
- ☐ 10. Question(s) submitted for Mayoral Appearance before the BOS on [ ]

Please check the appropriate boxes. The proposed legislation should be forwarded to the following:

☐ Small Business Commission ☐ Youth Commission ☐ Ethics Commission

☐ Planning Commission ☐ Building Inspection Commission

Note: For the Imperative Agenda (a resolution not on the printed agenda), use a Imperative Form.

Sponsor(s):

Clerk of the Board

Subject:

Hearing - Civil Grand Jury Report - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

The text is listed below or attached:

Hearing on the recently-published 2018-2019 Civil Grand Jury Report, entitled "Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System."

Signature of Sponsoring Supervisor: ____________________

For Clerk's Use Only:

190786

From: Anatolia Lubos
To: Carroll, John (BOS)
Subject: Fire Commission Response to 2018-2019 AWSS Report
Date: Friday, September 13, 2019 10:03:24 AM
Attachments: Copy of Fire Commission Nakajo AWSS Matrix of Findings and Recommendations Response 190904.xlsx

---

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Thursday, September 12, 2019 1:24 PM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Civil Grand Jury Report

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 1:24:22 PM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Rasha Harvey; Steve Nakajo (sknakajo@yahoo.com); Nicholson, Jeanine (FIR)
Subject: RE: Civil Grand Jury Report

⚠ **WARNING: This email was generated from an external source. You should only open files from a trustworthy source.**

Here's the correct document.

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

From: Conefrey, Maureen (FIR)
Sent: Thursday, September 12, 2019 11:45 AM
To: CGrandJury@sftc.org
Cc: Rasha Harvey <r.harvey@sfcgj.org>; Steve Nakajo (sknakajo@yahoo.com) <sknakajo@yahoo.com>; Nicholson, Jeanine (FIR) <jeanine.nicholson@sfgov.org>
Subject: Civil Grand Jury Report

Dear Honorable Garrett L. Wong,

Please see attachments.   I will also send by U.S. Mail.

Sincerely,

Maureen Conefrey
Fire Commission Secretary
(415) 558-3451

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	Cisterns serve as one of many important tools for use by the SFFD in response to a disaster. Cistern locations are strategically located in the City in the event of a major conflagration to assist as a "Demarcation Line" on some of The City's major thoroughfares. This was realized after the 1906 earthquake. With work accomplished through the ESER bond program, cisterns have been seismically improved throughout the City and the overall number of cisterns has increased to approximately 230, providing the Fire Department access to millions of gallons of water in an emergency.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Department is currently finalizing specifications for these units, after which they will go out to bid through the City's procurement processes before construction. It is anticipated the Department will take receipt of these units in the second half of 2020/early 2021. These hose tenders are a heavy-duty apparatus designed to be able to be deployed and moved throughout the City depending on need, giving the Department needed operational flexibility in its response.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. While the Department currently has five older hose tenders spread-out throughout the City, these new units are much more modern and provide the Department with a number of operational benefits, including the following: the capability of pumping and drafting water from any water source; extending the current AWSS system infrastructure; carrying 6,000 feet of hose for deployment; a 5,500 gallon per minute (GPM) on-board water pump and a 3,000 GPM portable submersible water pump; on-board monitor with a 525 foot reach; and four wheel drive. In addition, the Department has been successful in advocating and receiving Federal grant funds to assist with purchasing various PWSS equipment (valves, hose, ramps, etc.), and will continue to advocate for alternative sources of funding to increase the inventory of PWSS equipment.	R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]	Requires further analysis	The Fire Department has been allocated funding to purchase five units through funds from the FY19-20 City budget and an allocation from the State. The Department is currently working with the Office of Contract Administration to develop a multi-year term contract for hose tenders so in the case that additional funding is secured in future years, the Department will be able to reduce the amount of time for procurement of the apparatus. Each hose tender cost $1 million each, and we need to weigh purchase of additional hose tenders to other budget request and priority.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]	Will be implemented	The Fire Department conducts weekly hose/hose tender drills that it rotates through companies throughout the City. The Fire Department will work with the SFPUC to have them in attendance and participate in these drills. SFFD will also commit to working with the PUC to enhance the scope and frequency of trainings in the future for improved collaboration. SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

From:	Anatolia Lubos
To:	Carroll, John (BOS)
Subject:	San Francisco Public Utilities Commission Response (by the Commission President) to the 2018-2019 AWSS Report
Date:	Friday, September 13, 2019 10:14:02 AM
Attachments:	President Caen Letter to CGJ.pdf

From: Civil Grand Jury <CGrandJury@sftc.org>
Sent: Wednesday, September 11, 2019 11:11 AM
To: Anatolia Lubos <ALubos@sftc.org>
Subject: FW: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

---

From: Hood, Donna
Sent: Wednesday, September 11, 2019 11:10:54 AM (UTC-08:00) Pacific Time (US & Canada)
To: Civil Grand Jury
Cc: Kelly Jr, Harlan; Breed, London (MYR)
Subject: Response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report

⚠WARNING: This email was generated from an external source. You should only open files from a trustworthy source.

Good Morning,

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*.

Thank you,

Donna Hood
Commission Secretary
San Francisco Water, Power and Sewer/Services of the San Francisco Public Utilities Commission
525 Golden Gate Ave., 13th Floor
San Francisco, CA 94102
415-554-0761 (direct)
http://sfwater.org/

Conserve a drop today for a drink tomorrow! Learn how at www.sfwater.org/conservation

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

September 11, 2019

Sent via U.S. Mail and email to CGrandJury@sftc.org

The Honorable Garrett L. Wong
Presiding Judge
Superior Court of California, County of San Francisco
400 McAllister Street, Room 008
San Francisco, CA 94102-4512

Dear Judge Wong:

In accordance with Penal Code Sections 933 and 933.05, and pursuant to the request of Mr. Rasha Harvey, Foreperson of the City and County of San Francisco 2018-19 Civil Grand Jury, attached please find the response of the San Francisco Public Utilities Commission to the 2018-2019 Civil Grand Jury Report, *Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System*. At its regularly scheduled public meeting of September 10, 2019, the Commission voted to approve the attached responses by Resolution No. 19-0178.

The response of the General Manager of the San Francisco Public Utilities Commission is being sent under separate cover.

The Commission would like to thank the members of the 2018-2019 Civil Grand Jury for their service and their interest in our vital water infrastructure that supports firefighting in all communities in San Francisco.

Sincerely,

Ann Moller Caen
President
San Francisco Public Utilities Commission

cc: Harlan Kelly, SFPUC General Manager
Mayor London Breed

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. 19-0178

WHEREAS, On July 17, 2019, the 2018-2019 Civil Grand Jury released a report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System," a copy of which is on file with the Commission Secretary and has been provided to this Commission for review; and

WHEREAS, The Civil Grand Jury requires written responses from this Commission to the Report's Findings Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13, and Recommendations Nos. 1, 2, 6, 7, 9, and 10; and

WHEREAS, California Penal Code §933(c) requires such written responses be submitted to the Presiding Judge no later than September 15, 2019; and

WHEREAS, Attached hereto are the Commission's responses to the above stated Findings and Recommendations in the 2018-19 Civil Grand Jury Report; now, therefore be it

RESOLVED, That this Commission hereby approves the Commission's responses, attached hereto, to the relevant findings and recommendations of the July 17, 2019 Civil Grand Jury Report entitled, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System" and authorizes and directs the Commission President to submit the response to the Presiding Judge of the Civil Grand Jury by September 15, 2019, as required by California Penal Code §933(c).

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of September 10, 2019.

Donna Hood

Secretary, Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The MWSS has been significantly upgraded in the last 15 years through the Water Supply Improvement Program (WSIP) initiated by the SFPUC. The goals of WSIP included to reduce vulnerability of the water system to damage from earthquakes and increase overall water system reliability. There were 35 in-city projects within the $4.8 billion-dollar program. The WSIP was the largest capital program ever undertaken by San Francisco, and one of the largest water infrastructure programs in the nation. Additionally, it is one of the only comprehensive and strategic infrastructure programs targeted specifically at improving a water system's seismic reliability and resiliency. Additionally, it is unique because the WSIP utilized a 7.8 magnitude earthquake as its seismic Level of Service.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	The SFPUC, SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the AWSS system's seismic reliability and range of coverage. Enhancing the AWSS range of coverage to all areas of the City would require the allocation of funds to do so. The three agencies will continue to develop and implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the City intends to use the best possible technology available to meet the performance standards of the SFFD.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding	As the City considers what is essential to protect San Francisco, it is important to acknowledge our multiple, complex resilience challenges. These challenges are documented in the Resilient SF strategy (2016) and underlie the strategic efforts of our capital investments as represented in the 10-Year Capital Plan (last updated 2019). These challenges are: Earthquakes, Sea Level Rise/Climate Change, Aging Infrastructure, Unaffordability, and Social Inequity. All of these challenges represent meaningful threats to San Franciscans, their property, and their ability to make a life in the city. In making decisions about priority investments, San Francisco must keep an eye on all of these challenges, identify the areas of greatest need across them, and make progress on all fronts simultaneously. The City has taken significant steps since 2010 to ensure that the City has a high-pressure multi-sourced, seismically safe EFWS. Since the passage of the first Earthquake Safety and Emergency Response Bond in 2010, SFPUC, SFFD, SF Public Works have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	Ensuring that San Francisco has the infrastructure and resources to be well prepared to fight fires in all parts of San Francisco is something that will be a focus of the next 10-Year Capital Plan. Per Administrative Code 3.20, that Plan must be submitted to the Mayor and Board no later than March 1 of each odd-numbered year for approval no later than May 1. The requested presentation would be delivered as part of that Plan's submission to enable holistic planning across San Francisco's resilience challenges. Updates available on this timeline would be included. The City cannot discuss the project and timeline until the ESER 2020 plan passes. For this reason, the City will sync this recommendation with the Capital Plan, and push back the timeline to December 31, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Decisions about programming and funding levels of future ESER bonds and other complementary sources that could support the expansion of the AWSS have yet to be made.	R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]	Requires further analysis	The commitment of sources for specific uses on specific timelines for San Francisco's public infrastructure is the work of the 10-Year Capital Plan. The plan discussed in Recommendation 1 will be acknowledged in the Capital Plan, and based on analysis, will be done on the capital plan timeline. The capital planning process gathers, documents, and balances planned funding for needs across the public infrastructure portfolio and across San Francisco's resilience challenges. The Capital Plan has longstanding funding principles to guide the prioritization of public infrastructure investments. These investments are tiered: (1) address legal and/or regulatory mandates; (2) ensure public safety and enhance resilience; (3) preserve assets and promote sustainability; (4) advance planned and programmatic needs; and (5) promote economic development. In the next 10-Year Capital Plan and those that follow, the City will continue to analyze priority projects and programs and identify sources to advance those priorities. Committing to entirely funding a single program out of context and without regard for the trade-offs of that commitment would be out of step with the City's longstanding and highly regarded capital planning process and likely create significant vulnerabilities elsewhere in the portfolio.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]	Agree with the finding		R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	While it is true that the SFPUC and SFFD are studying four potential water sources proposed to supply a potable EFWS on the west side of the City, which are not located north of Golden Gate Park, which by no means would reduce the proposed system's resiliency, reliability, performance, or ability to provide abundant high-pressure water for fire suppression to the Richmond District after a seismic event. San Francisco is unique in that there are 11 in-city reservoirs, with a total water capacity of approximately 413,000,000 gallons. Additionally, Lake Merced, also located within City Limits, has an additional approximately 1,000,000,000 gallons. The potable EFWS system for the Westside of San Francisco that is being developed and analyzed would provide that the new EFWS pipeline in the Sunset and Richmond Districts could be supplied from four sources of water at two locations. The first two water sources could be supplied to the EFWS pipeline via a 30,000 gallon per minute pump station in the vicinity of Lake Merced. The two sources being studied for this pump station are Lake Merced, which has a water supply of approximately one billion gallons, and a 60" seismically resilient SFPUC Hetch Hetchy Regional Water System pipeline. The proposed potable EFWS also is analyzing the inclusion of a second 30,000 gallons per minute pump station in the vicinity of the SFPUC's Sunset Reservoir that could be supplied water by two sources: (1) the 90 million gallon north basin of the Sunset Reservoir, which recently underwent a $64 million seismic retrofit, and (2) a 54" seismically resilient SFPUC Hetch Hetchy Regional Water system pipeline.	R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this study by June 30, 2021.

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	Fire Response Areas (FRAs) were utilized by SFPUC and SFFD in the planning study CS-199. This study divided the City into areas based on those defined by the SFFD for initial alarm response and were called Fire Response Areas (FRAs). Probable fire demands were developed for each FRA using 1000 sets of fire demands generated by Charles Scawthorn, PhD using a Monte Carlo analysis of fire ignitions and fire growth using the ground motions from the design earthquake (7.8 magnitude). The fire ignitions were generated using methods similar to those used for the Community Action Plan for Seismic Safety (CAPSS) study (ATC 2010). The fire ignitions subsequently were used to develop water demands that were aggregated into the likely fire demands for each FRA. The water supplies for each FRA were developed using the reliability modeling tool GIRAFFE, developed at Cornell University by Professor Thomas D. O'Rourke. GIRAFFE performs internal Monte Carlo analysis to damage pipes in the system for multiple scenarios. The water supplies developed by GIRAFFE were aggregated into the likely water supplies for each FRA. It should be noted that the likely water supplies for each FRA assumed no water from the City's municipal water system (MWSS), which is quite conservative and highly unlikely even after a seismic event. The reliability score for each FRA is calculated using the sum of all water supplies for each FRA and dividing it by the FRA water demand. The reliability scores do exactly that - estimate how much EFWS water will be available for firefighting demands in a given FRA. The reliability scores are not meant to represent an estimate of the fire protection for a given house, block, or blocks. Rather it is a measure of the EFWS capacity and demand. The SFPUC recognizes the need to analyze potential EFWS demands on a more detailed level, and the agency began the process of doing so.	R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFPUC and SFFD will complete this analysis by June 30, 2021.
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	The EFWS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the majority of the city's population at that time. Since 2010, the SFPUC, SFFD, and Public Works have made critical improvements to the existing EFWS system. Expanding the EFWS prior to ensuring that the existing EFWS is resilient and reliable would have contradicted best engineering practices. The SFPUC and SFFD are developing plans that would implement a resilient, robust, and redundant potable EFWS for the Westside of San Francisco. The potable EFWS that is being developed and analyzed would propose the best method for bringing a robust and resilient high-pressure firefighting water system to the Western neighborhoods in San Francisco that is capable of providing water to the SFFD firefighters at the high-pressure needed for firefighters to combat large fires after a seismic event, and is likely to include over 14 miles of new EFWS pipelines and potentially two new pump stations likely to be supplied by four water sources. The SFPUC and SFFD's potable EFWS is being designed in a manner that allows for agility and the flexibility to add new technologies and water sources, and in a manner that allows the piping network to be extended in the future to serve additional areas.					

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, wholly	Since taking over maintenance responsibilities, SFPUC has completed significant maintenance activities. For example, on a monthly basis, staff from the SFPUC test both Pump Station #1 and Pump Station #2. There are 6 maintenance recommendations provided in the CS-199 study as shown below in Table 7-1 from CS-199. The SFPUC has developed several of the routine maintenance plans recommended in the report or has determined the recommended maintenance practice is not necessary (i.e. flushing of a non-potable water system). Maintenance Recommendations, CS. 199 Task 11 TM: Maintenance Recommendation 1: Confirm that all AWSS assets are entered into CDD's asset management system and PM's are established SFPUC Response: All AWSS asset locations are entered into CDD's Maximo and GIS databases. PM's are established for regular maintenance. Maintenance Recommendation 2: Perform Regular maintenance and testing SFPUC Response: According to SFPUC Maximo maintenance/testing records, regular maintenance and testing is performed in accordance with maintenance plans. Maintenance Recommendation 3: Check, flush and repair all suction connections regularly SFPUC Response: All suction connections were assessed 4-5 years ago. Some were cleaned as needed at that time. A high-pressure jetting machine was recently purchased, and personnel is being trained on its use. Maintenance Recommendation 4: Establish pipeline flushing program for AWSS SFPUC Response: Non-potable fire-fighting water systems are not typically flushed as part of regular flushing maintenance program. However, flushing naturally occurs when the AWSS is utilized approximately 20 times per year. Maintenance Recommendation 5: Establish leak detection program and a pipeline leak database to monitor potential hot spots SFPUC Response: SFPUC maintenance activities have helped reduced EFWS leakage by over 500,000 gallons per day, improving system performance while reducing water waste. A condition assessment project was implemented using Smart Ball technology. In addition, the system water supply sources are regularly monitored for water levels/filling requirements which will indicate potential leaks in the pipeline system. Maintenance Recommendation 6: Establish a cistern inspection, filling and testing program SFPUC Response: A cistern inspection and testing program has been developed for implementation in 2019. In addition, a filling procedure has been established with SFFD. As part of the AWSS Critical Valve Exercise Program, CDD has identified 66 AWSS valves as "critical" (66 of 1,685 valves, or approximately 4 percent (source: CDD GIS). Critical valves for AWSS were defined based on the following criteria for operational importance: • Tank bypass valves • Tank supply valve from higher pressure to lower pressure tank supply source • Closed control valves to isolate piping within an infirm area • Distribution system divide gate valve, manual operation (allows higher pressure zone to feed into lower pressure zone within the distribution	R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]	Has been implemented	(a) SFPUC implements "best practices" for the maintenance of AWSS assets in collaboration with SFFD, and consistent with the terms of the Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression (MOU), SFPUC will seek SFFD's written approval for "any modifications that could compromise" the system's function as a high pressure firefighting system (MOU, page 2). (b) The AWSS critical valves have been identified and will be exercised every year through the AWSS Critical Valve Exercise Program.

					pressure zone to feed into lower pressure zone within the distribution system) • Distribution system divide gate valve, motorized operation (allows higher pressure zone to feed into lower pressure zone within the distribution system) • Open control valves to allow a single supply source to feed an infirm area • Balancing valve, TP reservoir only (allows the two TP reservoir basins to equalize in level) Critical Valves: These EFWS critical valves are broken down by type below. All 66 of the AWSS critical valves were exercised in 2018-2019 and will be exercised every year. Valve Type (# of Critical Valves per type): Ashbury Tank By-Pass Valves (10) Ashbury Tank Supply Valve #1 [Ashbury to Jones] (1) Ashbury Tank Supply Valve #2 [Ashbury to Jones] (1) Close Control Gate Valve (15) Division Gate Valve (14) Jones Street Tank By-Pass Valves (10) Motorized Division Gate Valve or Motorized Line Gate Valve (6) Open Control Gate Valve [Infirm Area] (6) Twin Peaks East Reservoir Lead Valve [Supply, TP to Ashbury] (1) Twin Peaks Reservoir Balancing Valve (1) Twin Peaks West Reservoir Lead Valve [Supply, TP to Ashbury] (1) Total AWSS Critical Valves (66)					
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]	Disagree, partially	There are no formal protocol outlining specific joint AWSS exercises or drills in the MOU; however, there are multiple opportunities to train together during operation, maintenance, and construction of improvement projects for the AWSS facilities as previously described in the response to the Grand Jury questions sent in May 2019. The SFFD and SFPUC have had multiple field training opportunities during the maintenance and start-up testing of AWSS facilities in the last 5 years. For example, on December 20, 2018, SFFD and SFPUC personnel conducted emergency generator start-up procedures for Pump Station No. 2 (PS2). On April 5, 2018 SFPUC and SFFD performed joint-department full-scale test of AWSS Pump Station No. 1 (PS1) including pumping seawater into an isolated section of the AWSS distribution through system hydrants. On August 29, 2018, SFPUC, SFFD and DPW personnel conducted a seawater drafting drill and confirmation test from the new suction connection at Pier 50. In addition, SFFD and SFPUC periodically test different facilities to assure systems are in good working order, and to train personnel on operations and joint-agency communications. For example, a full-scale emergency exercise was performed between SFFD and SFPUC staff in January 2016 at Islais Creek, which involved the Phoenix Fireboat pumping sea water directly into an isolated section of the Jones pressure system via AWSS manifold connection. Sea water discharged from select hydrants within the isolated section of the system where pressure and flow were monitored at each discharge point. The SFFD uses their Disaster Response Manual and Water Supply Manual to provide guidelines for training. Training occurs throughout the year and is ongoing. In March 2018, the SFPUC sponsored a tabletop drill focused on CDD emergency response in coordination with SFFD response. Participants were asked to utilize Incident Command Structure (ICS) principles to	R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]	Will be implemented	SFFD and SFPUC will work together to amend the MOU by June 30, 2020.

					respond to a hypothetical earthquake event (determine ICS, formulate specific objectives, and document findings). It is anticipated that this tabletop exercise will be repeated at least every other year, and that a larger scale simulation of post-earthquake response will be conducted within the next two years for SFFD and SFPUC joint-exercise. In February 2018 the SFPUC and SFFD staff convened to review the SFPUC's Division Emergency Operations Plan (DEOP), the CDD's Emergency Action Plan (EAP), and the CDD's Emergency Response Plan (ERP). The ERP overview focused on the Incident Command structure specific to CDD staff responsibilities, communication methods, critical facilities and assets, first responders for each facility (PWS and AWSS) and updated "critical facilities map" for all major pressure zones.					

BOARD of SUPERVISORS

City Hall
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco 94102-4689
Tel. No. 554-5184
Fax No. 554-5163
TDD/TTY No. 554-5227

MEMORANDUM

Date: July 24, 2019

To: Honorable Members, Board of Supervisors

From: AC Angela Calvillo, Clerk of the Board

Subject: 2018-2019 CIVIL GRAND JURY REPORT - Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 17, 2019, the 2018-2019 Civil Grand Jury issued a press release, publicly announcing issuance of their report, entitled:

Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

On July 18, 2019, the Civil Grand Jury issued an updated report, including appendices which we inadvertently omitted from the July 17 public release.

Pursuant to California Penal Code, Sections 933 and 933.05, the Board must:

1. Respond to the report within 90 days of receipt, or no later than October 15, 2019; and
2. For each finding the Department response shall:
   - agree with the finding; or
   - disagree with the finding, wholly or partially, and explain why.
3. For each recommendation the Department shall report that:
   - the recommendation has been implemented, with a summary of how it was implemented;
   - the recommendation has not been, but will be, implemented in the future, with a timeframe for implementation;
   - the recommendation requires further analysis, with an explanation of the scope of the analysis and timeframe of no more than six months from the date of release; or
   - the recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Pursuant to San Francisco Administrative Code, Section 2.10, in coordination with the Committee Chair, the Clerk will schedule a public hearing before the Government Audit and Oversight Committee to allow the Board the necessary time to review and formally respond to the findings and recommendations.

Continues on following page

The Budget and Legislative Analyst will prepare a resolution, outlining the findings and recommendations for the Committee's consideration, to be heard at the same time as the hearing on the report. These matters are anticipated for hearing in Government Audit and Oversight during a regular committee meeting in September 2019.

If you have any questions, please contact John Carroll, Assistant Clerk, at (415) 554 4445.

Attachments: July 17, 2019 Press Release; and
July 18, 2019 Updated Report: Act Now Before it is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System

c:
Honorable Garrett L. Wong, Presiding Judge
Sophia Kittler, Mayor's Office
Kanishka Karunaratne Cheng, Mayor's Office
Andres Power, Mayor's Office
Sally Ma, Mayor's Office
Rebecca Peacock, Mayor's Office
Jon Givner, Office of the City Attorney
Ben Rosenfield, City Controller
Todd Rydstrom, Office of the Controller
Peg Stevenson, Office of the Controller
Tonia Lediju, Office of the Controller
Alisa Somera, Office of the Clerk of the Board
Debra Newman, Office of the Budget and Legislative Analyst
Severin Campbell, Office of the Budget and Legislative Analyst
Reuben Holober, Office of the Budget and Legislative Analyst
Jennifer Millman Tell, Office of the Budget and Legislative Analyst
Rasha Harvey, 2018-2019 Foreperson, San Francisco Civil Grand Jury
Lori Campbell, 2017-2018 Foreperson, San Francisco Civil Grand Jury
Naomi M. Kelly, City Administrator, Office of the City Administrator
Lynn Khaw, Office of the City Administrator
Brian Strong, Office of the City Administrator
Debbie Raphael, Director, Department of the Environment
Peter Gallotta, Department of the Environment
Charles Sheehan, Department of the Environment
Jeanine Nicholson, Chief, Fire Department
Theresa Ludwig, Fire Department
Stephen Nakajo, President, Fire Commission
Maureen Conefrey, Fire Commission
Harlan L. Kelly, Jr., General Manager, San Francisco Public Utilities Commission
Juliet Ellis, San Francisco Public Utilities Commission
John Scarpulla, San Francisco Public Utilities Commission
Christopher Whitmore, San Francisco Public Utilities Commission
Ann Moller Caen, President, San Francisco Public Utilities Commission
Donna Hood, San Francisco Public Utilities Commission

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]			
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]			

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]					R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]					R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		

Report Title [Publication Date]	F#	Finding (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Finding Response (Agree/Disagree)	Finding Response Text	R# [for F#]	Recommendation (text may be duplicated due to spanning and multiple respondent effects)	Respondent Assigned by CGJ [Response Due Date]	Recommendation Response (Implementation)	Recommendation Response Text
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Mayor [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Mayor [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Mayor [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	General Manager, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	Chief, San Francisco Fire Department [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	Chief, San Francisco Fire Department [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	Chief, San Francisco Fire Department [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief, San Francisco Fire Department [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F13	In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	Chief, San Francisco Fire Department [September 15, 2019]			R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	Chief, San Francisco Fire Department [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	Chief, San Francisco Fire Department [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Chief Resilience Officer, Office of the City Administrator [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Director, San Francisco Department of the Environment [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Budget and Legislative Analyst Office, Board of Supervisors [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R3 [for F1-F6]	The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	Board of Supervisors [October 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	Board of Supervisors [October 15, 2019]			R8 [for F5, F6, F11]	By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	Board of Supervisors [October 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Public Utilities Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Public Utilities Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Public Utilities Commission [September 15, 2019]			R7 [for F10]	The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Public Utilities Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F12	The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	President, San Francisco Public Utilities Commission [September 15, 2019]			R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Public Utilities Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F1	Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F2	The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F3	Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F4	The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	President, San Francisco Fire Commission [September 15, 2019]			R5 [for F4]	The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F5	A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R1 [for F1-F6]	By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R2 [for F1-F6]	The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F6	Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F7	The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	President, San Francisco Fire Commission [September 15, 2019]			R4 [for F6-F7]	As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F8	Redundancy is an important feature of an emergency firefighting water system.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F9	Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	President, San Francisco Fire Commission [September 15, 2019]			R6 [for F8-F9]	The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	President, San Francisco Fire Commission [September 15, 2019]		
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F10	The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]	F11	The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	President, San Francisco Fire Commission [September 15, 2019]							
Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R9 [for F12]	By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	President, San Francisco Fire Commission [September 15, 2019]		

Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System [July 17, 2019]						R10 [for F13]	By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	President, San Francisco Fire Commission [September 15, 2019]		

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

FOR IMMEDIATE RELEASE

Contacts: Rasha Harvey, Foreperson, 415-716-8258
Stephen Garber, Committee Chairperson, 510-682-4693

***** PRESS RELEASE *****

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR EMERGENCY FIREFIGHTING WATER SYSTEM

San Francisco, CA, July 17, 2019 – San Francisco is notoriously vulnerable to fires following a major earthquake. Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system -- that provides excellent firefighting protection to parts of the City. However, the Civil Grand Jury found that large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS, and would be particularly vulnerable to fire damage when the next major earthquake strikes.

City leaders have known about this deficiency for decades, but have yet to develop concrete plans or a timeline to provide a robust emergency firefighting water supply for all neighborhoods. In 2014, the US Geological Survey estimated that there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043. Plans to develop a seismically safe high-pressure AWSS for the western portion of the City are now moving forward. However, at the City's current pace and funding levels, expansion of AWSS protections to inadequately protected neighborhoods will not be completed for 35 years or more – well after the USGS predicts that one or more major earthquakes will strike. The Civil Grand Jury, therefore, recommends that, by the end of 2020, the City present a detailed plan to extend AWSS protections to all neighborhoods, with an accelerated completion date of no later than 2034.

As an interim measure, the Grand Jury strongly recommends that the Mayor and the Board of Supervisors approve the San Francisco Fire Department's (SFFD) request to replace and expand its portable water supply system (PWSS). Comprised of specially equipped trucks ("hose tenders"), the PWSS can distribute pressurized water from many sources for long distances, and can be built and operational in one to two years. The Grand Jury recommends that these new PWSS hose tenders be strategically placed in Districts 1, 4, 7, and 11 -- neighborhoods lacking in AWSS protections. Although the Mayor's draft budget includes funds for 4 new hose tenders, this is barely sufficient to replace the current inventory of 5 tenders, all of which are past their useful lives.

The Grand Jury also recommends that the San Francisco Public Utilities Commission and the SFFD jointly develop "best practices" to ensure the proper maintenance of all AWSS assets, and that these agencies adopt and implement annual emergency response exercises, which include simulated earthquake drills using both AWSS and PWSS assets.

ACT NOW BEFORE IT IS TOO LATE

Experts tell us that San Francisco is overdue for another major earthquake like the one that devastated the City in 1906. Nevertheless, City officials have not prioritized plans to expand the high-pressure emergency firefighting water supply to all neighborhoods. This is a problem that threatens the lives and property of over one-third of our City's residents. City officials should make the expansion of emergency firefighting protections to all San Franciscans a matter of high priority, before it is too late.

Civil Grand Jury reports may be viewed online at http://civilgrandjury.sfgov.org/report.html.

###

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

MEMORANDUM

TO: Mayor and Members of the Board of Supervisors

CC: Angela Calvillo, Clerk of the Board of Supervisors

FROM: Anatolia Lubos, Grand Jury Administrative Analyst

DATE: July 18, 2019

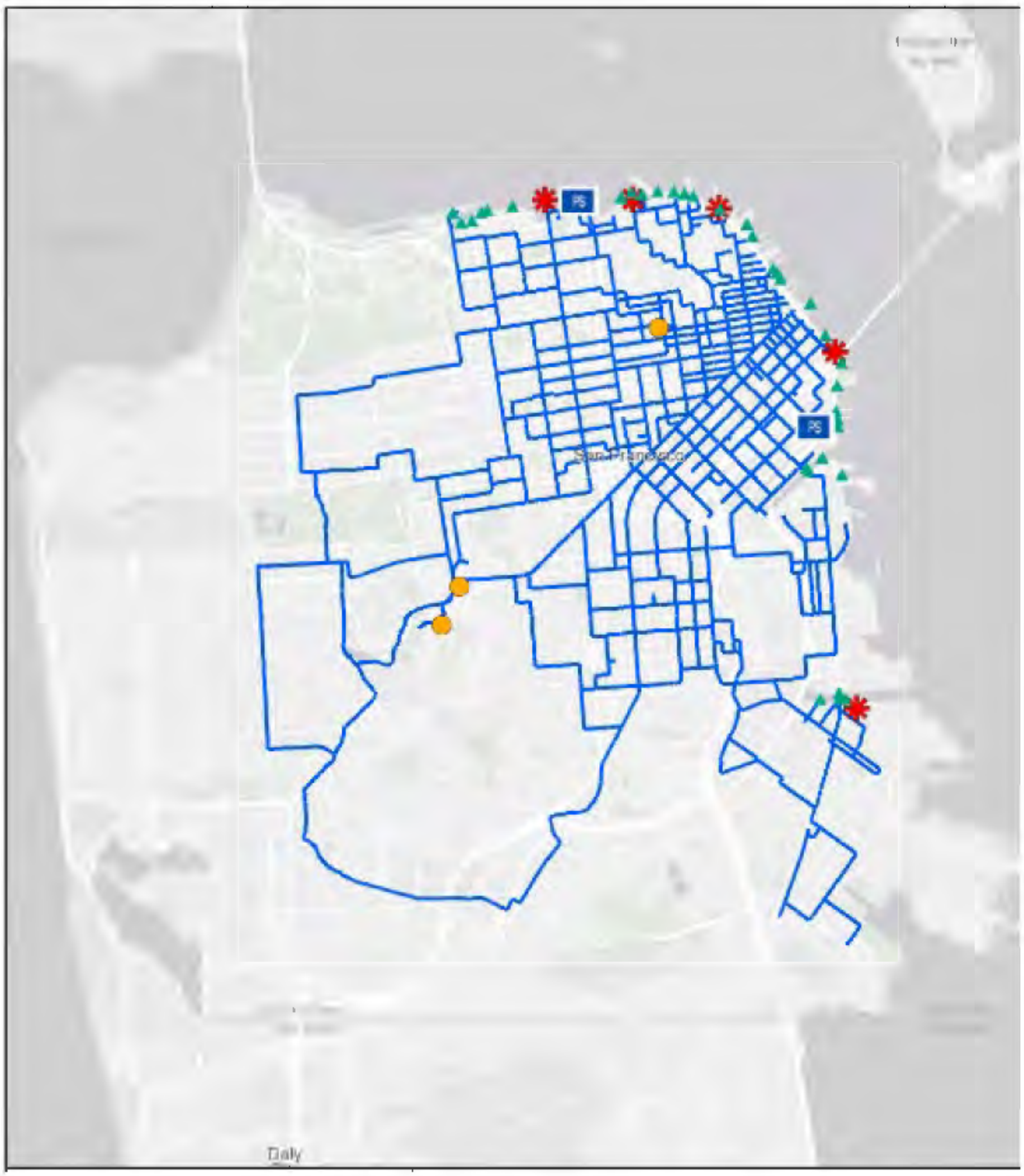
SUBJECT: Civil Grand Jury Report, "Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"

The previous version of the aforementioned Civil Grand Jury report as received and distributed on Monday, July 15, 2019 was incomplete and omitted Appendices F to R (inclusive).

Enclosed is the complete report.

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

ACT NOW BEFORE IT IS TOO LATE: AGGRESSIVELY EXPAND AND ENHANCE OUR HIGH-PRESSURE EMERGENCY FIREFIGHTING WATER SYSTEM



City and County of San Francisco
2018-2019 Civil Grand Jury

THE CIVIL GRAND JURY AND ITS OPERATIONS

California state law requires that all 58 counties impanel a Grand Jury to serve during each fiscal year. *California Penal Code Section 905; California Constitution, Article I, Section 23*

The Civil Grand Jury investigates and reports on one or more aspects of the County's departments, operations, or functions. *California Penal Code Sections 925, 933(a)*

Reports of the Civil Grand Jury do not identify individuals interviewed by name. *California Penal Code Section 929*

The Civil Grand Jury issues reports with findings and recommendations resulting from its investigations to the Presiding Judge of the Superior Court. *California Penal Code Section 933(a)*

Each published report includes a list of those elected officials or departments that are required to respond to the Presiding Judge of the Superior Court within 60 or 90 days as specified. *California Penal Code Section 933*

California Penal Code Section 933.05 is very specific with respect to the content of the required responses. Under Section 933.05(a), for each finding, the response must:

1) Agree with the finding, or
2) Disagree with it, wholly or partially, and explain why.

Similarly, under Penal Code Section 933.05(b), for each recommendation, the responding party must report that:

1) The recommendation has been implemented, with a summary of the implemented action; or
2) The recommendation has not been implemented but will be within a set timeframe; or
3) The recommendation requires further analysis, with an explanation of what additional study is needed, and the timeframe for conducting that additional study and the preparation of suitable material for discussion. This timeframe may not exceed six months from the date of publication of the Civil Grand Jury's report; or
4) The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Any San Francisco resident who is a US citizen and is interested in volunteering to serve on the Civil Grand Jury for the City and County of San Francisco is urged to apply. Additional information about the San Francisco Civil Grand Jury, including past reports, can be found online at http://civilgrandjury.sfgov.org/index.html .

CITY AND COUNTY OF SAN FRANCISCO
2018-2019 CIVIL GRAND JURY

MEMBERSHIP ROSTER

RASHA HARVEY (Foreperson)

JANET ANDREWS HOWES (Parliamentarian)

LINDA BADGER

ANDREW BENJAMIN

GORDON CRESPO

KRISTINE EQUIHUA (Technology Secretary)

STEPHEN GARBER

JONATHAN HILL

LEONARD KULLY (Correspondence Secretary)

WILLIAM LEE (Foreperson Pro Tem)

FRANK NETTLETON

NONA RUSSELL

RANDALL SMITH (Recording Secretary)

KAAREN STRAUCH BROWN

RUSH STURGES

MARTHA SUTHERLIN

JASON TAM

MICHAEL WIXTED

EXECUTIVE SUMMARY

San Francisco is one of the most vulnerable cities in the world, and certainly in the United States, to the risk of fire following an earthquake. In 1906, the City suffered tremendous destruction and devastation from the fires that followed a major earthquake. Over 3,000 people died and approximately 28,000 buildings were destroyed. In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage. We know the question is when, not if, another major earthquake will strike San Francisco and ignite numerous fires.

The Civil Grand Jury believes it is essential that we take prompt and aggressive action to expand and enhance our defenses against the inevitable fires following an earthquake before it is too late. All parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – deserve to be well protected against this catastrophic risk.

Today, the City has a seismically safe high-pressure Auxiliary Water Supply System (AWSS) -- separate and distinct from the low-pressure municipal water supply system (MWSS) -- that provides excellent firefighting protection to parts of the City. However, large parts of the City, such as the outer Richmond, outer Sunset, and Bayview/Hunters Point, among others, do not have a high-pressure AWSS and are not nearly as well protected.

Plans to develop a seismically safe high-pressure AWSS for the western portions of our City are now moving forward. But even though City leaders have known about this issue for decades, the City still does not have concrete plans or a timeline to provide a more robust emergency firefighting water supply for all parts of the City that need one.

In 2014, the U.S. Geological Survey (USGS) estimated there is a 72 percent chance of one or more magnitude 6.7 or greater earthquakes striking the Bay Area between 2014 and 2043. Earlier this year Mayor London Breed announced that planning for such a disaster is a priority. But at our current pace and funding levels, expansion of a high-pressure AWSS to currently unserved parts of the City will not be completed for another thirty-five (35) years or more–well after the USGS predicts we will be struck by one or more major earthquakes.

The Civil Grand Jury makes the following recommendations, among others which are more fully discussed herein:

- The City should be prepared to fight fires in all parts of the City in the event of a repeat of a 1906 size earthquake;
- The City should aggressively develop a high-pressure, multi-sourced, seismically safe emergency water supply for those parts of the City that don't currently have one, with a target completion date of no later than 2034;
- As an interim measure, the City should immediately replace and expand its inventory of Portable Water Supply System (PWSS) hose tenders, which are comparatively cheap, can be acquired much more quickly than the high-pressure AWSS, and were essential in fighting the 1989 Loma Prieta fire, but are now past their useful life;
- The new PWSS hose tenders should be strategically placed in those areas of the City that do not have a high-pressure, multi-sourced, seismically safe emergency water supply.

TABLE OF CONTENTS

List of Figures **Page No.**

List of Tables **Page No.**

BACKGROUND AND PROBLEM STATEMENT

No one knows when the next large earthquake is coming. But it is coming.

A. Fire Following Earthquake Is a Major Risk to The City

"San Francisco will sustain major damage from fires following future earthquakes, in addition to the damage caused by shaking."[1] As explained in a 2010 report prepared for the City,

> In San Francisco, over 90 percent of buildings are constructed from wood, many of them directly touching their neighbor buildings. Earthquakes in places with this type of construction have caused the two largest peacetime urban fires in history: in 1906 in San Francisco and in 1923 in Tokyo.[2]

A main reason the 1906 fire was so devastating is that the earthquake destroyed much of the water system.[3]

Fires following earthquakes remain a major threat today. In 1994, approximately 110 fires were ignited after the Northridge earthquake in Los Angeles County, even though it was "only" a 6.7-magnitude earthquake.[4] In 1995, the 6.9-magnitude Kobe, Japan earthquake ignited over 100 fires, with several large conflagrations and major fire damage.[5] In Kobe "broken water

---

[1] Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010) ("ATC 52-1, Potential Earthquake Impacts"), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[2] *Id.*; footnote omitted.

[3] See Scawthorn, C., O'Rourke, T. D. & Blackburn, F., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*, Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; see also Scawthorn, C., Water Supply In Regard to Fire Following Earthquake, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 5.

[4] See discussion in Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 7; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 12-17.

[5] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 17-19; ATC, 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

mains left the fire department helpless, and fires destroyed more than 7,000 buildings."[6] A magnitude 7.9 earthquake would be an estimated 10 times larger than a magnitude 6.9 earthquake, and would release approximately 31 times more energy.[7]

San Francisco is by far the most densely populated large city in California and is the second most densely populated large city in the country.[8] With mostly wood construction in many areas, this dense City remains at significant risk.[9]

B. AWSS Background and Current Status

After the 1906 earthquake and its devastating fires, the City built an independent emergency water supply for firefighting, known as the AWSS.[10]

The AWSS is a separate, non-potable emergency firefighting water supply system that at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations.[11] Applying a "belt

---

[6] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

[7] See the United States Geological Survey's "How Much Bigger ….?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can compare the relative size and strength of different magnitude earthquakes.

[8] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 6.

[9] Ibid.

[10] See generally SFPUC, Frequently Asked Questions–Fire Suppression Water Systems, dated November 2017 "SFPUC 2017 FAQ", https://sfwater.org/modules/showdocument.aspx?documentid=11507 attached as Appendix N; see also Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf

[11] AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report), February2014 ("CS-199"), at p. 7, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; SFPUC Fact Sheet, dated Summer 2012, located at https://www.sfwater.org/modules/showdocument.aspx?documentid=2501 and printed March 6, 2019. The online Fact Sheet is outdated, as the City has added approximately 30 more cisterns through the 2010 and 2014 ESER bonds. The SFFD also has three large capacity fireboats berthed at Pier 22 ½ and an additional, smaller fireboat berthed at the San Francisco Marina Yacht Harbor.

People sometimes confuse Emergency Firefighting Water System (EFWS) and AWSS, or use them interchangeably. EFWS is the broader concept, including all emergency sources of water and the means for delivering them. AWSS is sometimes described as including cisterns, and other times not. Compare CS-199, at p. 7, ("AWSS is a water supply system consisting of pipelines, cisterns, reservoir, storage tanks, and salt-water pump stations.") https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 with AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report, January 5, 2018 ("2018 Westside Options Analysis"), at pp. 10-13, 20 (differentiating between EFWS and AWSS, and discussing cisterns as a supplement to but not part of AWSS), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

and suspenders" approach, if the City's MWSS mains break leaving low-pressure hydrants useless, firefighters will have access to other sources of water, including the Twin Peaks Reservoir and the Bay. Unlike the MWSS, AWSS pipelines were designed to withstand movement from an earthquake.[12]

The AWSS is "remarkably well designed to furnish large amounts of water for firefighting purposes under normal conditions and contains many special features to increase reliability in the event of an earthquake."[13] The AWSS is "designed to provide water at higher pressures than the potable water system, allowing firefighters to use water from the AWSS hydrants without requiring a fire engine."[14]

Another of the key features of the AWSS is its redundancy. The HP AWSS was designed with both a redundant water supply and a gridded main system.[15] This feature provides a more reliable emergency water supply system, allowing potential pipe breaks to be bypassed.[16] As succinctly stated by an outside expert, "the AWSS achieves high reliability by having multiple sources, a highly redundant network and special piping and valves."[17]

The AWSS was originally built over 100 years ago, at a time when the northeast portion of the City contained both the central business district and the majority of the City's population.[18] As a result, the multi-sourced, HP AWSS pipeline network primarily covers just the northeastern part of the City.[19]

The City has been considering expanding the HP AWSS for decades. For example the Analysis by the Ballot Simplification Committee of 1986's Proposition A, Fire Protection Bonds, specifically noted that parts of the City were not served by the HP AWSS:

This report will use EFWS as the broader concept, and will generally use AWSS to refer to the HP AWSS (the 135 miles of pipelines and associated facilities but not including cisterns), although we will not change quotes. This distinction is important, as there are cisterns in the southern and western portions of the City, but not the HP AWSS.

[12] CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[13] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf,, at p. 80; see also Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp.12-15.

[14] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[15] *Id.*, at p. 37.

[16] Ibid.

[17] C. Scawthorn, January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis" "Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 .

[18] See SFPUC 2017 FAQ, Question 2, at https://sfwater.org/modules/showdocument.aspx?documentid=11507 , a copy of which is attached as Appendix N.

[19] *Id.*

> THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.[20]

In June 2003, the 2002-2003 Civil Grand Jury recommended that the HP AWSS be extended "to serve all parts of the City."[21] Yet three decades after the 1986 bond and 16 years after the prior Civil Grand Jury report, many neighborhoods still do not have HP AWSS pipelines.[22] Plans are moving forward to fund a new HP AWSS using potable water on the west side through an upcoming Earthquake Safety and Emergency Response Bond (ESER) issuance, but at the City's current pace it will take approximately 35 years or more to build out a HP AWSS pipeline system that serves all neighborhoods, including the southern portions of the City.[23] The City does not have a plan with a firm timeline for completion of this work or firm plans to fund all the work that needs to be done.

C. Problem Statement

Certain parts of the City, such as the northeast quadrant, are well protected against the risk of fires following an earthquake. These well-protected areas have a multi-sourced, redundant, Emergency Firefighting Water System (EFWS), including the HP AWSS. Unfortunately, other parts of the City are protected only by the low-pressure MWSS and by cisterns, which are not

[20] The 1986 Ballot Simplification Committee Analysis explained the proposal for Proposition A as paying for improvements including extending the high-pressure system and installing a high-pressure pump station at Lake Merced. Proposition A passed, but large areas of the City still do not have the protection of the independent high-pressure water system, and Lake Merced still does not have a high-pressure pump station. A copy of the Analysis by the Ballot Simplification Committee of the 1986 Proposition A is attached as Appendix L.

[21] 2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf , at p. 2.

[22] Neighborhoods currently without HP AWSS hydrants include Bayview Heights, Crocker Amazon, Excelsior, Ingleside, Merced Manor/Parkside, Mission Terrace, Oceanview, Outer Mission, Outer Richmond, Outer Sunset, Portola, Sea Cliff, Stonestown, and Sunnyside. A map showing the current layout of HP AWSS pipelines is on the cover and is attached as Appendix I.

[23] March 4, 2019 and March 11, 2019 SFPUC presentations and accompanying materials provided to the Emergency Firefighting Water System Management Oversight Committee. The amount of funding potentially available through the 2020 ESER bond and through water rates has been increased since the March 2019 Emergency Firefighting Water System Management Oversight Committee meetings. Thus, it *may* now be somewhat less than the 35 years presented in March. It has been difficult to tie down the City's "pace of funding" given there are no firm long term plans and the amount of funding available through an ESER bond can and does change. Although 35 years may be off somewhat, it remains the best (indeed only) current articulation of pace of funding and a timeline provided to the Civil Grand Jury.

nearly as reliable for fighting fires following a major earthquake and, unlike the HP AWSS, need fire engine support to effectively deliver water to a fire.[24]

The problem addressed in this report is how to ensure that all parts of the City – north and south, east and west, rich and poor, downtown and residential neighborhoods – are well protected from fires following earthquakes before it is too late.

METHODOLOGY

Members of the Civil Grand Jury conducted interviews with representatives of:

- The San Francisco Public Utilities Commission
- The San Francisco Fire Department
- The San Francisco Department of Public Works
- The San Francisco Office of Resilience and Capital Planning
- The San Francisco Department of the Environment
- The San Francisco Fire Commission
- The Board of Supervisors

Members of the Civil Grand Jury also conducted interviews with:

- Retired members of the San Francisco Fire Department
- A retired fire chief from a local jurisdiction
- Technical experts in the fields of engineering, wildfires, and water supply for fighting fires after earthquakes
- Concerned community members

Members of the Civil Grand Jury reviewed numerous planning and engineering reports specifically focusing on the AWSS or the PWSS, listed in Appendix D.

Members of the Civil Grand Jury also reviewed the relevant parts of articles, publications and reports regarding fires following earthquakes and related issues. These more general sources, some of which discuss the AWSS or PWSS but are not solely focused on them, are listed in Appendix E. [25]

---

[24] See discussion of expected problems of relying on a municipal water supply system in Section D of the Discussion, at pp. 18-20.

[25] Several of these publications are technical papers, and the Civil Grand Jury is comprised of lay citizens. When we cite or refer to technical papers it is generally for the conclusions or other non-technical information; we do not purport to be knowledgeable regarding the intricacies of fire spread models or the like.

DISCUSSION

Succinctly stated, "water supply is critical to firefighting."[26] Without a reliable water supply, the San Francisco Fire Department (SFFD) cannot be realistically expected to fight fires following a major disaster such as an earthquake.

A. San Francisco is Highly Vulnerable to Fires Following a Major Earthquake

San Francisco is highly vulnerable to fire after an earthquake, more than any other city in the country.

As explained in a 2008 article for the International Association for Fire Safety Science,

> Densely built environments are highly vulnerable to disasters. Common problems include: (a) narrow streets enabling fire to spread easily from one building to another; (b) streets cluttered with collapsed buildings in an earthquake restricting fire engine access; (c) shortage of open spaces which function as fire breaks or evacuation sites; (d) older and less robust wooden houses that easily collapse and burn in an earthquake ….[27]

San Francisco has significantly higher population density than any other county in California, as shown in Figure 1 on the next page: [28]

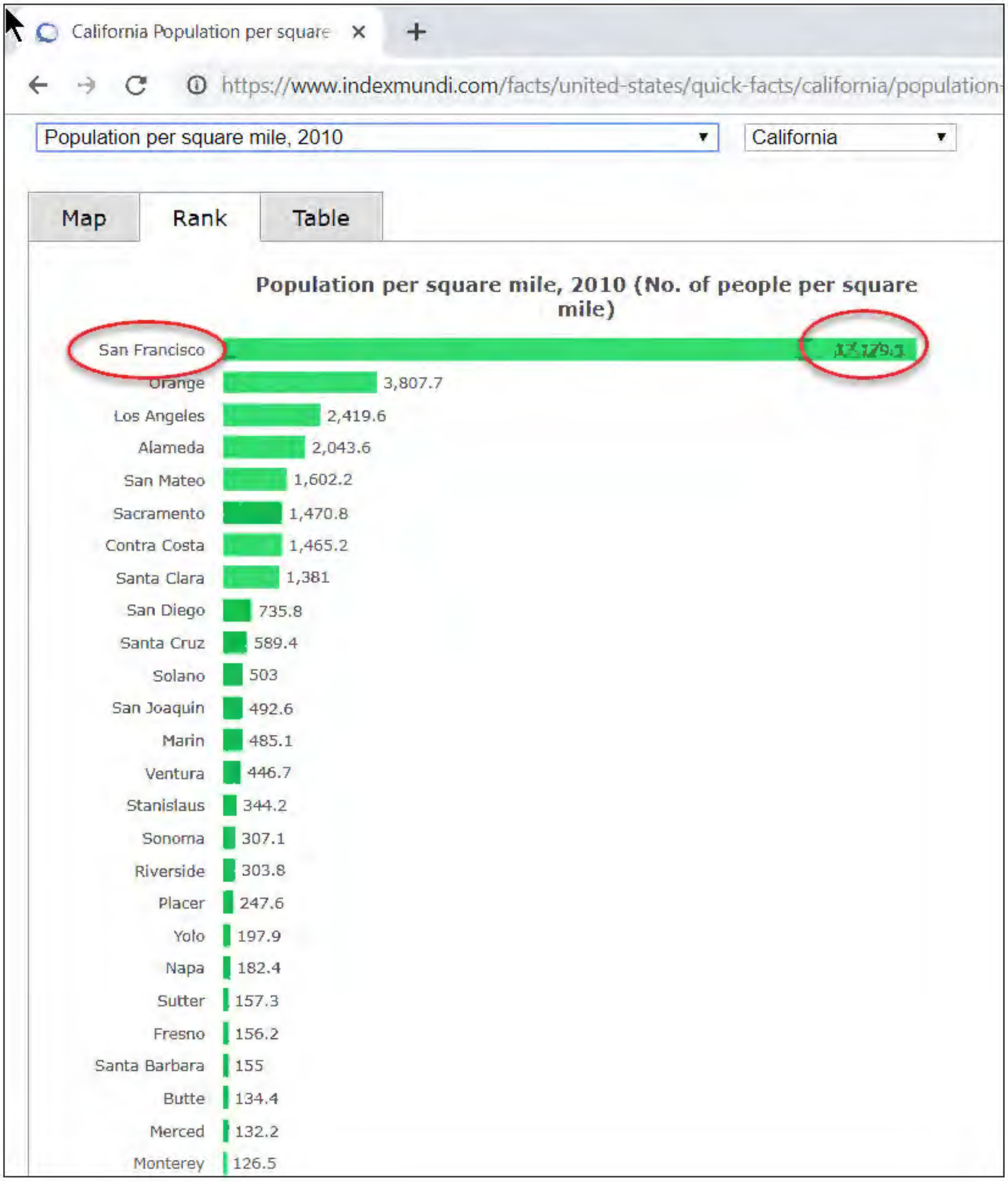
[26] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 12.

[27] Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf. at pp. 267-268 (parenthetical reference omitted). San Francisco does have streets that operate as fire breaks: Market St., Van Ness Ave., Geary St. (west of Gough), Dolores St., Mission St, 19th Avenue, Park Presidio Blvd., Alemany Blvd., and Third Street.

[28] See https://www.indexmundi.com/facts/united-states/quick-facts/california/population-density#chart .

Figure 1

Population Density By County



Similarly, based on 2016 data, San Francisco is the eighth densest city in the country with a population above 50,000, and other than New York City is the densest city with a population above 100,000:[29] See Figure 2, below.

Figure 2

Population Density by City

https://www.governing.com/gov-data/population-density-land-area-cities-map.html

aps & Data - Geography - U.S. Census Bureau

- Passaic, N.J.: 22,424 persons/sq. mile

The following table lists population densities for U.S. cities with populations of at least 50,000 as of 2016:

Search:

City	Population Density (Persons/Square Mile)	2016 Population	Land Area (Square Miles)
Union City, New Jersey	54,138	69,296	1
West New York, New Jersey	52,815	53,343	1
Hoboken, New Jersey	42,484	54,379	1
New York, New York	28,211	8,537,673	303
Passaic, New Jersey	22,424	70,635	3
Somerville, Massachusetts	19,738	81,322	4
Huntington Park, California	19,561	58,879	3
San Francisco, California	18,581	870,887	47
Jersey City, New Jersey	17,860	264,152	15
Paterson, New Jersey	17,438	147,000	8
Cambridge, Massachusetts	17,316	110,651	6
East Orange, New Jersey	16,528	64,789	4

San Francisco also has many narrow streets, and buildings that will almost certainly collapse in an earthquake and obstruct many streets, blocking traffic including fire engines. We also have a heavy concentration of older, wooden homes that are densely concentrated and highly flammable.[30]

---

[29] https://www.governing.com/gov-data/population-density-land-area-cities-map.html.

[30] ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at p. 25.

This is not just the Civil Grand Jury's perspective. Many experts, and numerous witnesses interviewed by the Civil Grand Jury, have opined that San Francisco faces "the most serious conflagration risk" and "will sustain major damage from fires following future earthquakes…."[31]

In July 2010, SPA Risk LLC (Dr. Charles Scawthorn, principal) prepared a report entitled, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, for the Applied Technology Council (ATC) on behalf of the City's Department of Building Inspection.[32] The report concluded that San Francisco is at "significant risk" due to fire following earthquake, and that the SFFD's fire engines[33] "will almost certainly not be able to respond to all post-earthquake fires, which are estimated to be about 100 on average (with a 10% chance of as many as 140) for a magnitude 7.9 San Andreas event."[34]

A key table in that 2010 report is copied below:

Table 1

Bounds for Losses to Buildings Due to Fire Following Earthquake[35]

	25% - 75% Confidence Range		
	Ignitions	Loss $ billions	Total Burnt Building Floor Area Mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~28.2
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

31 See, e.g., Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf , at p. iii ("Scawthorn 1987"); ATC 52-1, Potential Earthquake Impacts, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf at pp. vi, 25-29.

32 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf .

33 SFFD now has 44 frontline fire engines, and 19 relief engines, according to information provided by the SFFD. At the time of the 2010 report, the City apparently had 42 frontline engines.

34 Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2. A copy of the Abstract (or summary) of that report is attached as Appendix K.

35 Ibid. These estimates already take into account the AWSS system as it existed in 2010 (i.e., prior to the addition of more cisterns and other work performed under the 2010 and 2014 ESER bonds). The damage estimates do not include business interruption losses, loss of tourism or loss of property tax revenues.

As explained in that report, there is significant uncertainty regarding how many fires might be ignited following an earthquake, and the extent of damage they are likely to cause. One of the key variables is completely outside the City's control: wind. In 1989, the City was extremely lucky that there was no wind.[36] Indeed, "stronger wind conditions would have resulted in much greater fire spread in the Marina…."[37]

According to the 2010 report, there is a 25% chance that fires and damages could fall below the ranges in Table 1 on the preceding page, and an equal likelihood that they could exceed the ranges in that table.[38] Earlier this year (2019) the San Francisco Public Utilities Commission (SFPUC) engaged Dr. Scawthorn to update his analysis, but that update will not be completed until after this report has been issued. However, the key is not the precise numbers but "their overall magnitude."[39] Indeed, given the escalation in Bay Area home values over the last decade, one can only assume that the dollar loss estimates will increase substantially.

B. The USGS Warns the San Francisco Bay Area Has a High Likelihood of a Major Earthquake

In 2014, the USGS estimated there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area by 2043.[40] This was based on a new model, commonly referred to as the third Uniform California Earthquake Rupture Forecast, or UCERF3.[41]

Small earthquakes occur more frequently than large earthquakes.[42] According to the updated model, the probability that an earthquake magnitude 6.0 or larger will occur in the San Francisco region before 2043 is 98 percent. By comparison, the probability of at least one earthquake of magnitude 6.7 or larger is 72 percent for the same area, and the probability of at least one earthquake of magnitude 7.0 or larger is 51 percent. [43]

---

[36] Scawthorn and Blackburn, Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990.

[37] *Id.*, at p. 6.

[38] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2, attached as Appendix K.

[39] *Ibid*.

[40] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

[41] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

[42] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf , attached as Appendix G.

[43] UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf , attached as Appendix F.

Table 2 below is a simplified version of a table from a USGS fact sheet showing the likelihood of one or more events of varying size for the San Francisco region within the next 30 years based on this new model:[44]

Table 2

San Francisco Region Section of Table from March 2015 USGS Fact Sheet 2015-3009

San Francisco Region		
Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events
5	1.3	100%
6	8.9	98%
6.7	29	72%
7	48	51%
7.5	124	20%
8	825	4%

Although these figures are for the region, and not just the City and County of San Francisco, the predictions are sobering. To put these predictions in perspective, the 1989 Loma Prieta earthquake had a magnitude of 6.9, and, even though the epicenter was approximately 60 miles from San Francisco, it was the largest earthquake to strike the City since 1906.[45] Using the USGS online calculator,[46] a 7.5 magnitude earthquake, which has a 20% chance of happening by 2043, would be almost four times bigger than Loma Prieta, and would release almost eight times the energy. An 8.0 magnitude earthquake would be over 12.5 times bigger than Loma Prieta, and would release almost 45 times the energy. And this is without addressing the risk that the next major earthquake's epicenter could be much closer than 60 miles away.

---

44 *Id.*, at p.4; Table 2 above is a simplified version of Table 1 of Fact Sheet 2015-3009, attached as Appendix F.

45 See USGS, M 6.9 October 17, 1989 Loma Prieta Earthquake, https://earthquake.usgs.gov/earthquakes/events/1989lomaprieta/; USGS, M 6.9 - Loma Prieta, California Earthquake, https://earthquake.usgs.gov/earthquakes/eventpage/nc216859/executive.

46 See USGS, "How Much Bigger ….?" Calculator, located at https://earthquake.usgs.gov/learn/topics/calculator.php , where one can calculate how much bigger one earthquake is than another.

The USGS has also warned that the pace of large earthquakes is likely to increase:

> In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.[47]

The warnings and predictions from the USGS should be a wake-up call to all of us.

C. The Existing High-pressure AWSS System Only Covers Part of the City

The history and condition of the existing HP AWSS have been described in detail in multiple other reports.[48] Figure 2, on the following page, shows the location of the HP AWSS:[49]

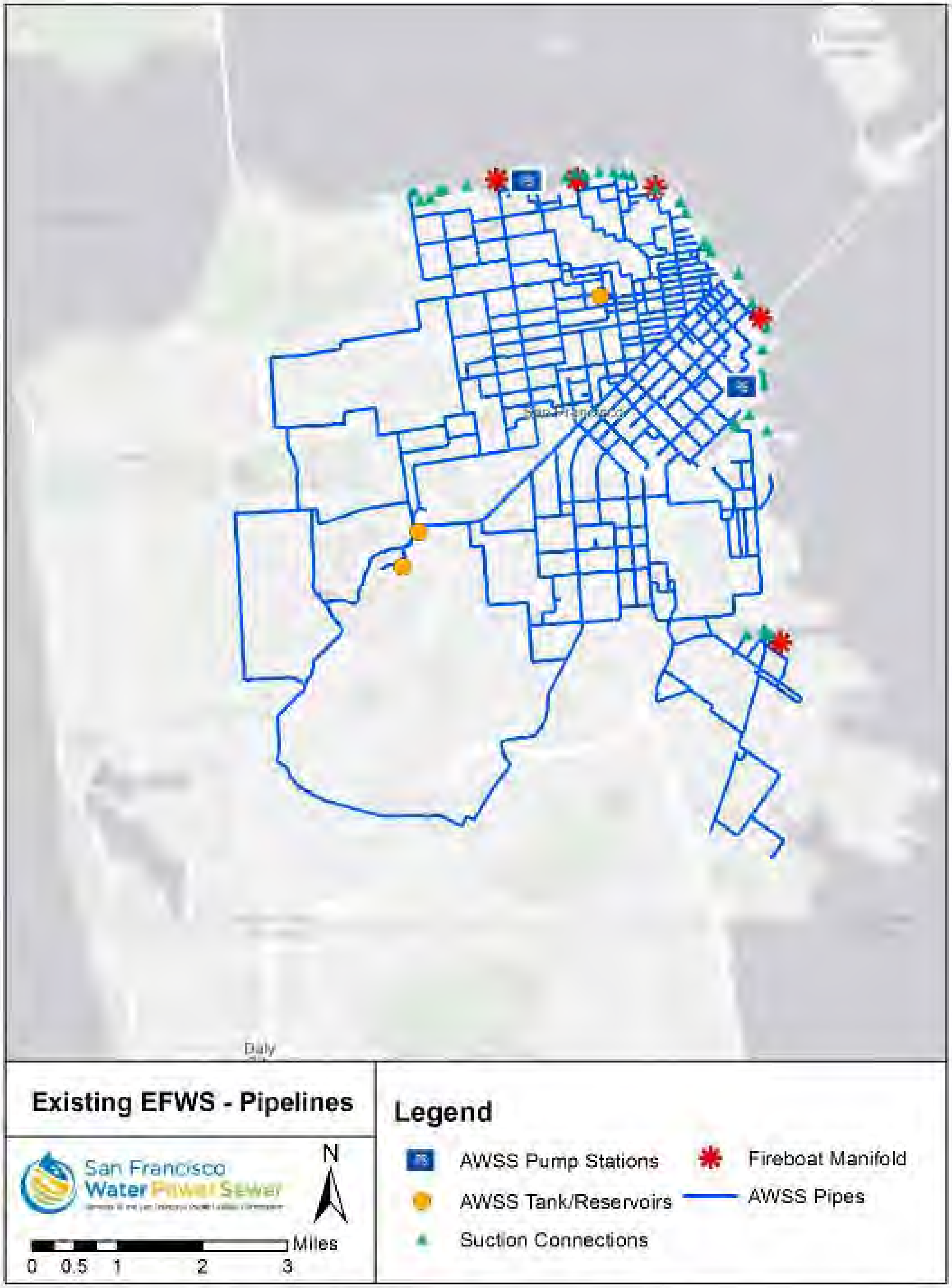
---

[47] USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf . See also Aster, R., California's other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517; *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[48] See, e.g., CS-199, at pp. 7-11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; Scawthorn, O'Rourke & Blackburn, 1906 Lessons, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf ; Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7 .

[49] Map supplied by the SFPUC on May 7, 2019.

Figure 3
Map of Existing High-Pressure AWSS



On a district by district basis, Supervisorial Districts 1, 4, 7 and 11 are not nearly as well protected by the HP AWSS as, for example, Districts 3 or 6:[50] See Table 3 below.

Table 3
HP AWSS Hydrants and Miles of Main by District

Supervisorial District	# of AWSS Fire Hydrants	Miles of AWSS Mains
1	42	5
2	170	14
3	327	23
4	3	0
5	188	16
6	366	27
7	79	7
8	110	9
9	110	9
10	222	18
11	24	1
TOTAL	1641	130

In fact, six of the eleven Supervisorial Districts, Districts 1, 4, 7, 8, 9 and 11, each have less than ten miles of AWSS mains. Districts 1, 4, and 11 each have less than 50 AWSS fire hydrants.

The areas not protected by the HP AWSS would need to rely primarily on getting emergency firefighting water supplies from the City's MWSS through its low-pressure hydrants or from cisterns. For a number of reasons detailed below, these resources are unlikely to provide adequate water to protect residents from fires after a major earthquake.

[50] Data provided by SFPUC on March 13, 2019.

D. The Municipal (Domestic) Water Supply System Is "Highly Vulnerable to Catastrophic Failure"[51]

No one knows with certainty what will happen in a major earthquake. But common sense says we should look at past experience and listen to experts when they warn us not to rely on the MWSS for firefighting following an earthquake.

As explained in a 2009 report prepared for the SFPUC,

> By their nature, domestic water mains are more vulnerable to earthquake damage. Numerous service connections and the jointed construction that is the industry norm contribute to their vulnerability.[52]

San Francisco has made a tremendous effort to improve and seismically reinforce its regional and local water system by means of the $4.8 billion Water System Improvement Project (WSIP).[53] The WSIP is one of the largest water infrastructure programs in the nation and the largest infrastructure program ever undertaken by the City. Among its objectives has been reducing the water system's vulnerability to earthquakes, with a particular emphasis on seismically reinforcing the regional delivery system, transmission mains, and reservoirs.[54]

Although the WSIP greatly enhances the reliability of the MWSS, and in particular the transmission mains and reservoirs, the 2009 report emphasizes that, unlike the HP AWSS, the local MWSS system is vulnerable to a major earthquake due to the numerous branches and service connections that can break and drain the system.[55]

This has been borne out by experience in San Francisco and elsewhere. In the 1906 earthquake, an estimated 23,000 breaks in the MWSS resulted in the loss of water and pressure.[56] In the much smaller 1989 Loma Prieta earthquake, there were 69 main breaks and 54 service

---

[51] See SF Fire Commission Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf at p.1. A copy of SFFC Resolution 2010-01 is attached as Appendix M.

[52] Metcalf & Eddy, at p. 18, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The SFPUC has initiated a planning study to better understand the current level of reliability of the entire potable distribution system, focusing on backbone pipes, but that study will take several years to complete.

[53] See SFPUC's WSIP webpage, https://sfwater.org/index.aspx?page=114 .

[54] See, e.g., list of WSIP projects at https://sfwater.org/index.aspx?page=968 .

[55] Metcalf & Eddy, at pp. 18-19, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00. The Civil Grand Jury is not questioning the importance or the efficacy of the WSIP, which is essential to rapidly restoring potable water service to residents following an earthquake. But fire suppression needs an immediately available supply of water, which the MWSS is unlikely to be able to provide following a major earthquake.

[56] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, p. 6. Other reports have provided somewhat different, but still extremely high estimates. Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 13 [over 28,000 breaks, including service breaks]. But whatever the precise number of water main breaks in 1906, the earthquake devastated the water supply system which contributed to the horrific fires that nearly destroyed the City.

connection breaks in the Marina district alone.[57] Because of these breaks, low-pressure hydrants located in the Marina could not provide adequate water or pressure for firefighting.[58]

Other recent major earthquakes have also caused substantial damage to municipal water supply systems. In the 6.7-magnitude 1994 Northridge earthquake, there were over 1,000 water main breaks and over 100 fires.[59] In the 6.9-magnitude 1995 Kobe, Japan earthquake, "water loss seriously impaired firefighting."[60] There were over 2,000 breaks in the underground piping, and large fires burned freely due to lack of water.[61] Similarly, in the 2011 Eastern Japan earthquake there was extensive damage to water supply lines.[62] Even the relatively small 6.0-magnitude 2014 South Napa earthquake "highlighted the vulnerability of water and wastewater systems to earthquake-related ground failure, the additional fire hazards that earthquake-related water system failures can pose, and the fiscal challenges that public agencies face in improving the seismic resiliency of these systems, both pre- and post-earthquake."[63]

Experts have predicted that in a future major San Francisco earthquake, the MWSS could sustain over 1,000 breaks.[64] Various reports have said it in different ways, but the clear takeaway is that the MWSS should not be relied upon to save the City from fires following a major earthquake:

- "MWSS pipes will sustain damage in certain areas of the City, which will impair the ability to deliver water for firefighting."[65]
- "In such an emergency it is likely that the potable water distribution system would be compromised by pipe breaks and leaks."[66]

---

[57] CS-199, at p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055; see also O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996) ("O'Rourke, Lessons Learned").

[58] Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

[59] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 16; O'Rourke, Lessons Learned, at p. 3.

[60] O'Rourke, Lessons Learned, at p. 3.

[61] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at pp. 18-19.

[62] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 24.

[63] Johnson, L. and Mahin, S., The 6.0 M_w South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf, Finding 2.3, at p. iii.

[64] Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at p. 2.

[65] CS-199, p. 11, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

- "…the usual firefighting water supplies will almost certainly fail…."[67]
- "World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake."[68]

Moreover, unlike AWSS hydrants, low-pressure hydrants connected to the MWSS require a fire engine to extract and pump the water to sufficient pressure for firefighting.[69] Given that fire engines are likely to be in high demand and potentially overwhelmed in a major earthquake, this is yet another reason why an alternative source of water is necessary.[70]

E. Cisterns Provide Limited Protection

Cisterns are underground tanks, unconnected to any water source.[71] Typically, cisterns in San Francisco hold approximately 75,000 gallons of water.[72]

The City has 229 cisterns located throughout the City, as shown by Figure 4 on the next page[73]:

[66] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 10.

[67] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf, at p. 39.

[68] SFFC Resolution 2010-01, p. 1, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf and attached as Appendix M.

[69] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 55-56.

[70] Scawthorn, O'Rourke & Blackburn, 1906 Lessons, at pp. S153-1S54, http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf .

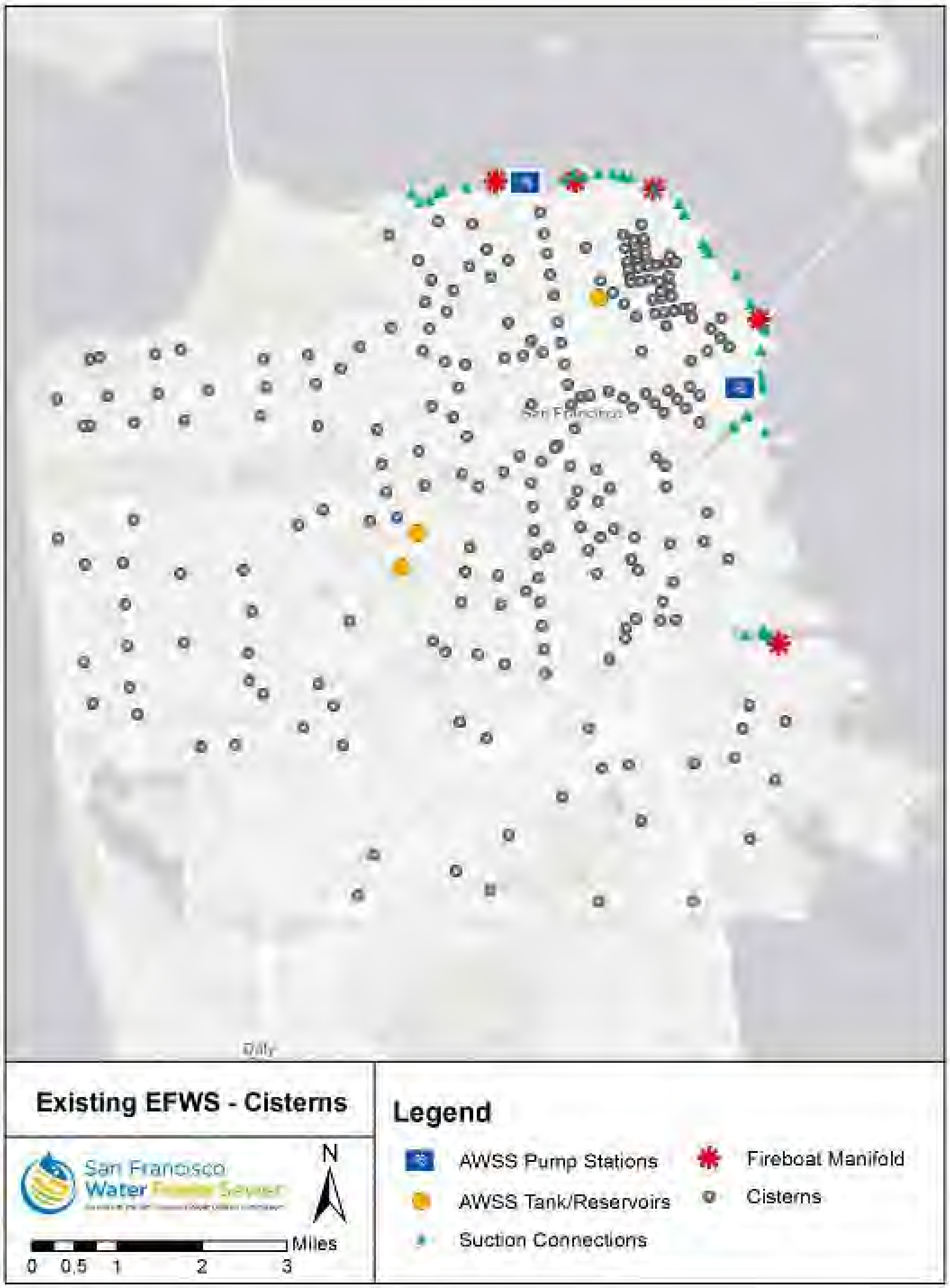
[71] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at p. 13.

[72] See SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 6.13-6.17; PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at p. 77.

[73] Map provided by SFPUC on May 7, 2019.

Figure 4

Map of Existing Cisterns



By Supervisorial District, the breakdown of cistern locations is listed in Table 4 below.

Table 4

Cisterns by Supervisorial District

Supervisorial District	Cisterns
1	17
2	23
3	46
4	12
5	20
6	26
7	12
8	27
9	21
10	20
11	5
TOTAL	229

Notably, Districts 1, 4, 7 and 11, which currently have the fewest miles of HP AWSS pipelines, also have the fewest cisterns. This is especially true of District 11, with only one mile of AWSS main pipeline and only five cisterns. [74]

Cisterns provide a valuable backup or "last resort" in the event of damage to the MWSS and AWSS. In the 1994 6.7-magnitude Northridge earthquake, the MWSS suffered over 1,000 water main breaks.[75] Firefighters used backyard swimming pools as water supply sources. In the 1906 earthquake, San Francisco's 23 cisterns were credited with saving a major building in the Financial District when the water mains broke.[76]

Cisterns, however, have limited capacity[77] and are therefore unlikely to be effective against serious fires following a major earthquake. In the 1995 6.9-magnitude Kobe earthquake,

[74] In recent years, the SFPUC has built 30 additional cisterns, funded by the 2010 and 2014 ESER bonds. These 30 new cisterns are included in the totals in the above table. Half of these new cisterns were strategically located in the Richmond and Sunset districts, which now have 17 and 12 cisterns, respectively, to begin to address concerns that those areas of the City were inadequately protected. SFPUC 2017 FAQ, Question 4, https://sfwater.org/modules/showdocument.aspx?documentid=11507 .

[75] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at pp. 12-17.

[76] Scawthorn 1987, http://www.sparisk.com/documents/AIRACFFEs.pdf , at p. S140.

[77] SFFD Water Supplies Manual, http://ufsw.org/pdfs/water_supplies_manual.pdf , at pp. 4.1, 5.6-5.7.

however, the city's 968 cisterns provided little help to firefighters because they drained in 10 minutes.[78]

San Francisco's typical cistern would drain within an hour of continuous firefighting.[79] Given that on average it takes several hours to put out a four-alarm fire,[80] cisterns cannot be expected to successfully fight post-earthquake conflagrations in parts of the City not protected by AWSS. In addition to providing limited firefighting water, cistern water must be extracted and pressurized by an engine, requiring more staff and time to deploy than, for example, AWSS hydrants.[81]

F. The PWSS Inventory Needs to Be Modernized and Expanded

In addition to the MWSS and cisterns, the SFFD intends to rely on the City's Portable Water Supply System, or PWSS, to fight fires in non-AWSS areas.

In the 1980s, the SFFD developed and implemented the PWSS, an above-ground, large-diameter hose system used to move water great distances from a water source to a fire. PWSS units consist of a hose tender, or truck, equipped with approximately one mile of large-diameter five-inch hose (larger than the normal three-inch hose), along with a portable pump, portable hydrants that allow water to be distributed from a large-diameter hose, and other essential firefighting equipment.[82] With its portable pump, a hose tender can be used to draft and pressurize water from alternative water sources, such as lakes, lagoons, a fireboat (as in the 1989 Loma Prieta earthquake), cisterns, or even broken water mains. It can also be used to extend the reach of the HP AWSS system to blocks or neighborhoods without a HP hydrant.[83]

---

[78] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at pp. 17-19. San Francisco's cisterns are larger than Kobe's, but the point remains they are only good for a limited duration. *Id.*, at p. 77.

[79] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf , at p. 77.

[80] Information provided by SFFD.

[81] CS-199, at pp. 13, 56, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

[82] Scawthorn, O'Rourke, Blackburn, S150-151. A detailed description of the PWSS can be found in Scawthorn, C. and Blackburn, F. (1990), Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC. The PWSS and its five-inch hoses are different from a prior, abandoned concept of a Flexible Water Supply System, using massive, 12-inch hoses in lieu of expanding the HP AWSS. That concept was proposed in AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246. It was abandoned as impractical after concerns over, among other things, how 12-inch diameter hoses would block traffic.

[83] Figure 6-1 on page 83 of CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, is a map of the City showing how the PWSS can be used to expand the areas protected by the AWSS. Figure 6-1 assumes certain extensions of the AWSS

Currently, there are only five PWSS hose tenders, three of which are located in the "unprotected areas"[84] of the Sunset district and Hunter's Point. In the SFFD's opinion, the PWSS hose tenders are "past their useful life."[85] The newest hose tender, housed in the Sunset, is 27 years old. The second newest, in Hunter's Point, is over 30 years old. The remaining three are over 45 years old.[86]

Firefighters and emergency response experts have been calling for a large-scale expansion of the PWSS for years.[87] In January 2010, the San Francisco Fire Commission (SFFC) issued Resolution 2010-01, encouraging the SFFD to pursue approximately $10 million in grant funding to expand the PWSS. The SFFC recognized that the City's MWSS is highly vulnerable to a catastrophic failure in the event of a major earthquake, and that the AWSS does not cover the entire City. The SFFC declared that the PWSS has been proven effective in the above-ground transmission of water for firefighting, that the PWSS can work in conjunction with and supplement the AWSS, and that the City did not have a sufficient number of units to supply all areas of the City where the AWSS does not extend.[88] Unfortunately, that grant was not funded, and the City has not yet purchased any additional PWSS hose tenders.[89]

Also in 2010, the Applied Technology Council issued several reports as part of the City's Community Action Plan for Seismic Safety, or the "CAPSS Project."[90] Among its recommendations was one similar to ours: Improve emergency water supply systems to cover those neighborhoods not served by the HP AWSS. As explained in that report,

> The Auxiliary Water Supply System provides a redundant water system for fighting fires after earthquakes and at other times, and incorporates many earthquake resistant features in its design. However, this system covers only northern and eastern City neighborhoods, those that were developed in the early

---

that do not presently exist, and does not take into consideration the limited size of the existing PWSS inventory. As a result, Figure 6-1 in CS-199 overstates the current level of protection, but does show what could be accomplished with a larger inventory of PWSS hose tenders.

[84] These areas are of course not completely unprotected, but as discussed above they do not have a HP AWSS. The City's outside expert AECOM/AGS, A Joint Venture, has referred to the portion of the City protected by the HP AWSS as the "Protected Area." See CS-199, at p. 8, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[85] Information provided by SFFD.

[86] Information provided by SFFD.

[87] See Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990, attached as Appendix Q.

[88] SFFC Resolution 2010-01, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf

[89] Information provided by SFFD.

[90] According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts. See https://sfgov.org/esip/capss .

part of the last century when the system was constructed. *The City needs adequate, reliable water sources to fight post-earthquake fires in all neighborhoods. There are a number of options to improve the water supply in neighborhoods not served by the Auxiliary System, including expanding the City's Portable Water Supply System, which can be deployed wherever needed. This important issue needs to be addressed as soon as possible*. (Emphasis added)[91]

In 2014, outside consultant AECOM/AGS, a Joint Venture, advised the City that "[a]dditional PWSS units would be a prudent investment for SFFD/SFPUC."[92]

The SFFD submitted a request for funding to purchase 20 newly designed PWSS hose tenders in the fiscal year 2019/2020 budget, but the Civil Grand Jury understands that only four new PWSS hose tenders are included in the Mayor's May 31, 2019 two-year budget proposal.[93] The proposed new SFFD hose tenders are designed to be more efficient and maneuverable than older models, with four-wheel drive to overcome obstacles on roads, the ability to carry up to 6,000 feet of five-inch fire hose, and only one firefighter required to operate each vehicle. Each vehicle will have a high-volume onboard water pump, and a portable submersible water pump. Both pumps will be able to draft water from the Bay, reservoirs, or other water sources. These new hose tenders could be connected together to carry water over many miles of the City. The SFFD estimates these new PWSS vehicles, fully equipped with hoses and appliances would cost approximately $1 million per vehicle.[94]

Given the time required to build or extend a HP pipeline system, acquiring additional PWSS hose tenders is a practical intermediate step to enhance fire protection throughout the City. The SFFD advised the Civil Grand Jury that additional PWSS hose tenders could be acquired and in service within a year or so, or at the outside two years. The failure to obtain grant monies should not stop the City from making this important investment in public safety.

Although the Civil Grand Jury recommends immediately replacing and expanding PWSS units, this is not a long-term solution. A successful PWSS deployment requires a nearby water source, and personnel to unwind a mile of heavy, five-inch-diameter hose through potentially

---

[91] Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety (2010), prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project, at pp. 53-54, https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

[92] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 85. Although this report referred to the PWSS as an investment in the colloquial sense, the PWSS is not a fixed asset and thus does not involve a capital expenditure. As such, purchasing new hose tenders will need to come from city funds, not bonds. The Civil Grand Jury nevertheless believes that acquiring more PWSS hose tenders is long overdue.

[93] Information provided by SFFD. The City's budget process is of course ongoing. It is therefore uncertain whether the Board of Supervisors will approve sufficient funding for the four new units or conversely whether the Board of Supervisors will increase the funding for purchasing new PWSS units. We also understand that a request for funding for PWSS hose tenders has been made to state officials, but at this time the SFFD does not know if that request has been approved.

[94] Information provided by SFFD.

congested and damaged city streets. [95] Moreover, although hose tenders can draft water from the Bay, they are not designed for use in the ocean – the only unlimited water source on the west side of the City.[96] Given these challenges, PWSS is essentially an important but temporary "Plan B."

G. Efforts to Expand the High-Pressure AWSS Need to Be Accelerated

As discussed in Section B above, the USGS estimates there is a 72 percent chance of a 6.7 or greater magnitude earthquake striking the Bay Area before 2043.[97] In early April of 2019, USGS researchers issued a new study warning that "the next 100 years of California earthquakes along [the San Andreas, San Jacinto and Hayward] faults could be a busy one."[98] Each year we delay construction of an expanded HP AWSS we are gambling, pushing our luck that a major earthquake won't hit before we're ready.

City departments, including the SFPUC, which assumed jurisdiction over the operation and maintenance of the AWSS from the SFFD in 2010, have been analyzing the reliability of the EFWS and the possible expansion of the HP AWSS for over a decade.[99] An analysis in 2009 indicated that the EFWS was "47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake."[100] In actuality, and as discussed in Section I below,[101] the SFPUC's consultant's metric is overly optimistic: a 50% score really means that we will have about half of the water needed to meet *median* firefighting demands following a 7.8-magnitude earthquake. Put differently, if the firefighting demands are above the median estimate, this analysis indicates that even with a score of 99% there will be insufficient water to meet the demand.

---

[95] Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, at pp. 4-5; information provided by SFFD.

[96] According to the SFFD, there is no known SFFD access to the ocean on the western side of the City, but SFFD is continuing to investigate potential access areas where it might be able to use a PWSS unit.

[97] See USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020, https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

[98] See *California's Current Earthquake Hiatus is an Unlikely Pause,* Seismological Society of America, published April 3, 2019, https://www.seismosoc.org/news/californias-current-earthquake-hiatus-is-an-unlikely-pause/, printed on April 5, 2019.

[99] See e.g., Metcalf & Eddy (2009), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00, CS-199 (2014), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229 (2015), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, 2018 Westside Options Analysis (2018), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, among other reports.

[100] SFPUC FAQ, Question No. 3, https://sfwater.org/modules/showdocument.aspx?documentid=11507 and attached as Appendix N.

[101] See pages 35-36 below.

Figure 5, below, shows EFWS reliability by so-called Fire Response Areas (FRAs)[102] as of 2010, i.e., prior to recent improvements.

Figure 5
Map of EFWS Reliability Scores by FRA as of 2010[103]

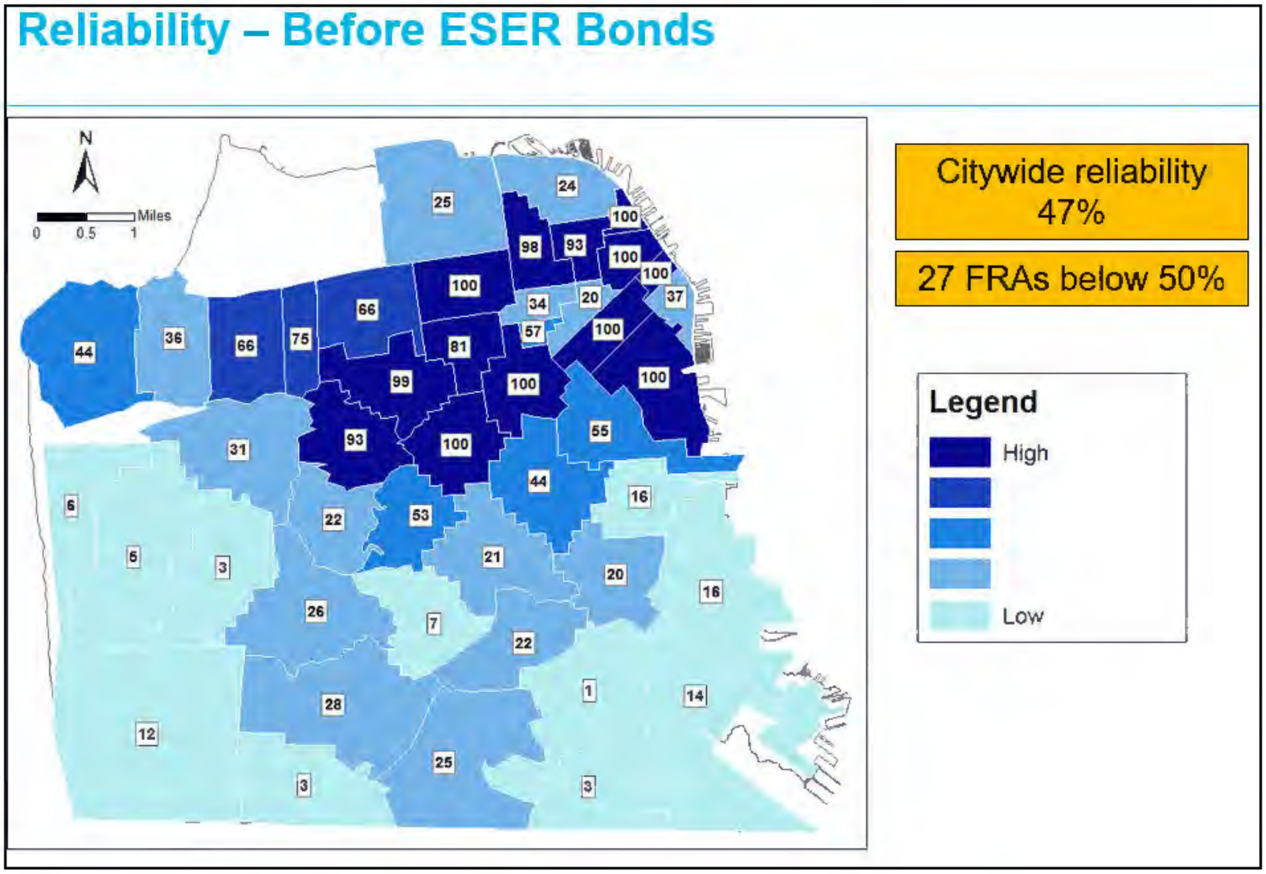


Figure 5 shows that as of 2010 the majority of the City scored below 50%, and in some cases far below. In 2010 and again in 2014, voters approved Earthquake Safety and Emergency Response (ESER) Bonds. The 2010 ESER bonds provided approximately $102 million for the EFWS, and the 2014 ESER bonds provided $54 million. The money was spent on assessing the existing HP AWSS, rehabilitating and upgrading core facilities (existing water storage tanks, pipelines, salt-water pumping stations) that needed seismic strengthening or other repairs or improvements, adding 30 cisterns, and other tasks.[104]

---

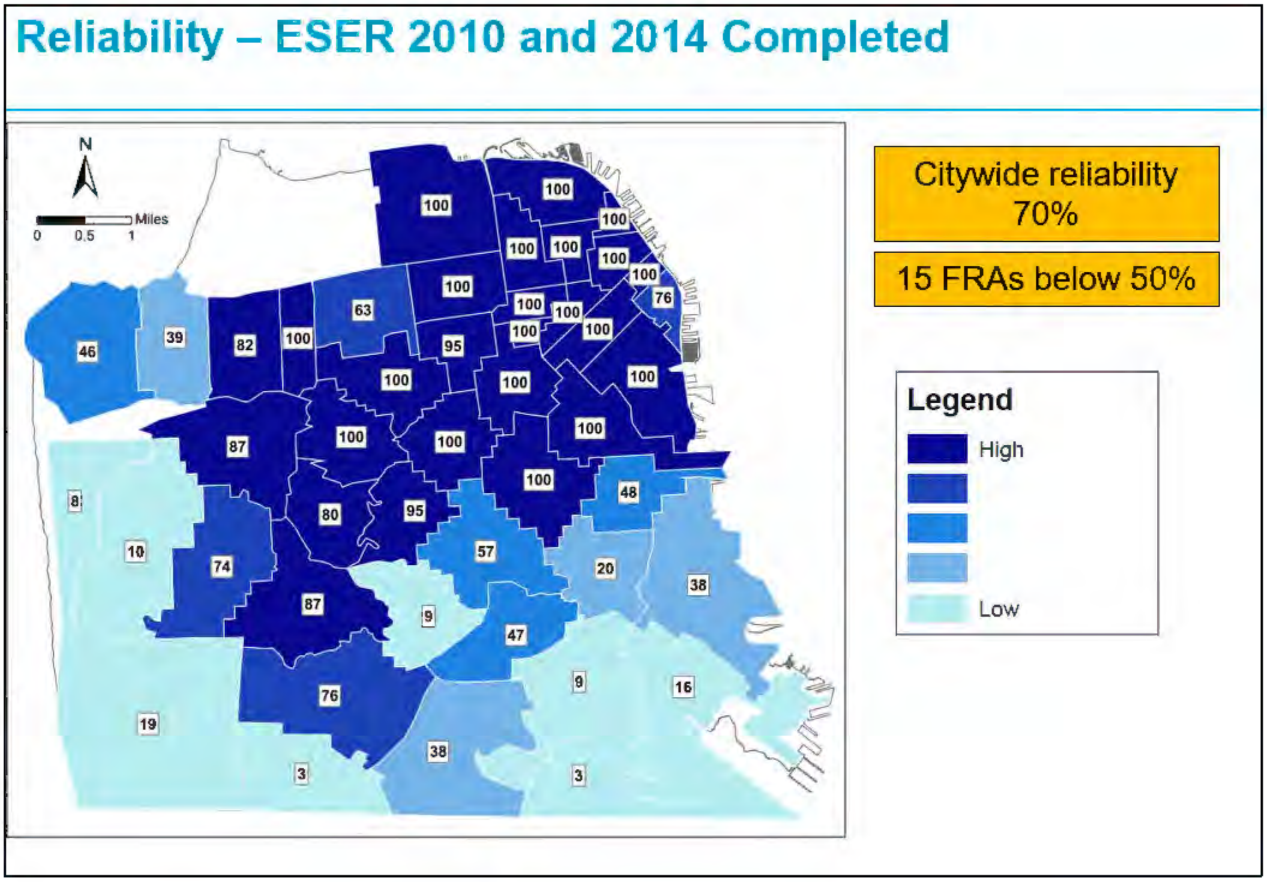
[102] The SFFD divides the City into 46 areas for initial alarm response, also referred to as Fire Response Areas or FRAs. A map showing the different FRAs is attached as Appendix J.

[103] Map supplied by SFPUC. Identical map, except for legend, in AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907 at p.3.

[104] A February 26, 2019 status list provided by the SFPUC for the various projects undertaken pursuant to the 2014 and 2014 ESER bonds, showing which are in planning, in design, in construction, complete, canceled or

The result has been significantly improved EFWS reliability scores, as shown by Figure 6:

Figure 6
Map of EFWS Reliability Scores by FRA After 2010 and 2014 ESER Bond Work Completed [105]



The SFPUC has performed important work in analyzing what needs to be done and by repairing existing facilities. *But today, nine years after the 2010 CAPSS report called for action as soon as possible, 16 years after the 2002-2003 Civil Grand Jury called for expanding the HP AWSS to the entire City, almost 33 years after the 1986 Fire Protection Bonds Analysis stating*

postponed is attached as Appendix O. See also Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found at http://www.sfearthquakesafety.org/eser-reports.html

[105] This map assumes completion of work in progress, which is expected by late 2020 according to the SFPUC. The SFPUC has retained outside experts to update the anticipated water demands by FRA but that work has not been completed.

the improvements would include extending the HP AWSS and installation of a HP pump station at Lake Merced, and over a hundred years after the AWSS system was first built, we are still decades away from reliably protecting all neighborhoods.

Over the past year, the SFPUC has made substantial progress in developing plans to improve EFWS on the west side. Specifically, the SFPUC and the SFFD propose to develop a new, separate AWSS system using potable water ("Potable AWSS") for the western part of the City. The Potable AWSS approach contemplates a dual-purpose pipeline, independent from the existing HP AWSS network.[106] The Potable AWSS would function as a potable water transmission main during normal operations and would provide HP emergency firefighting water supply for major fires. The new pipeline would provide "daily reliability and water quality benefits as well as a post-earthquake potable water supply to the Richmond and Sunset districts",[107] but in the event of an earthquake or other emergency, the transmission main would automatically be isolated from the remainder of the potable distribution system and converted to a dedicated HP system, similar to the existing or conventional AWSS.[108] To increase reliability, the new pipeline would be made of modern, seismically reliable material.[109]

The SFPUC currently anticipates having approximately $195 million,[110] from water rates and from an expected 2020 ESER bond (assuming voter approval), to spend on extending the HP AWSS and improving EFWS reliability over the next five to seven years.[111] The current Potable AWSS proposal is divided into two phases, as the projected $195 million is insufficient to

---

106 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at pp. 7, 10, 13.

107 *Id.,* at p. 8. The Potable AWSS would eliminate the need for a project that the SFPUC had been planning to supply potable water to the Richmond District, saving up to $30 million. *Id.* Today the potable water supply to the Richmond District depends on two transmission mains that run north from the Sunset District. One of those mains was built in 1915. The other was recently replaced with a ductile iron main. The Potable AWSS would provide a third transmission main, built with modern earthquake resistant pipe. *Id.*, at p. 13.

108 A detailed description of the Potable AWSS concept can be found in CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055, CS-229, https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246, and 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740. The actual proposal has evolved over time, so the alignment discussed in those 2014, 2015 and 2018 reports has changed, as have the water sources. This plan is still under review and the alignment may well change again before the plan is finalized and ready for any required public hearings or environmental or other review. But the underlying concept of a Potable AWSS and how it would operate remains the same.

109 New pipe would be so-called Earthquake Resistant Ductile Iron Pipe (ERDIP), the most seismically reliable pipe available. ERDIP pipe performed admirably in several recent Japanese earthquakes See Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 6, re ERDIP pipe.

110 Information supplied by the SFPUC. The $195 million is adjusted for inflation as the build out will occur over several years. This is roughly equivalent to $160 million in 2018 dollars according to the SFPUC.

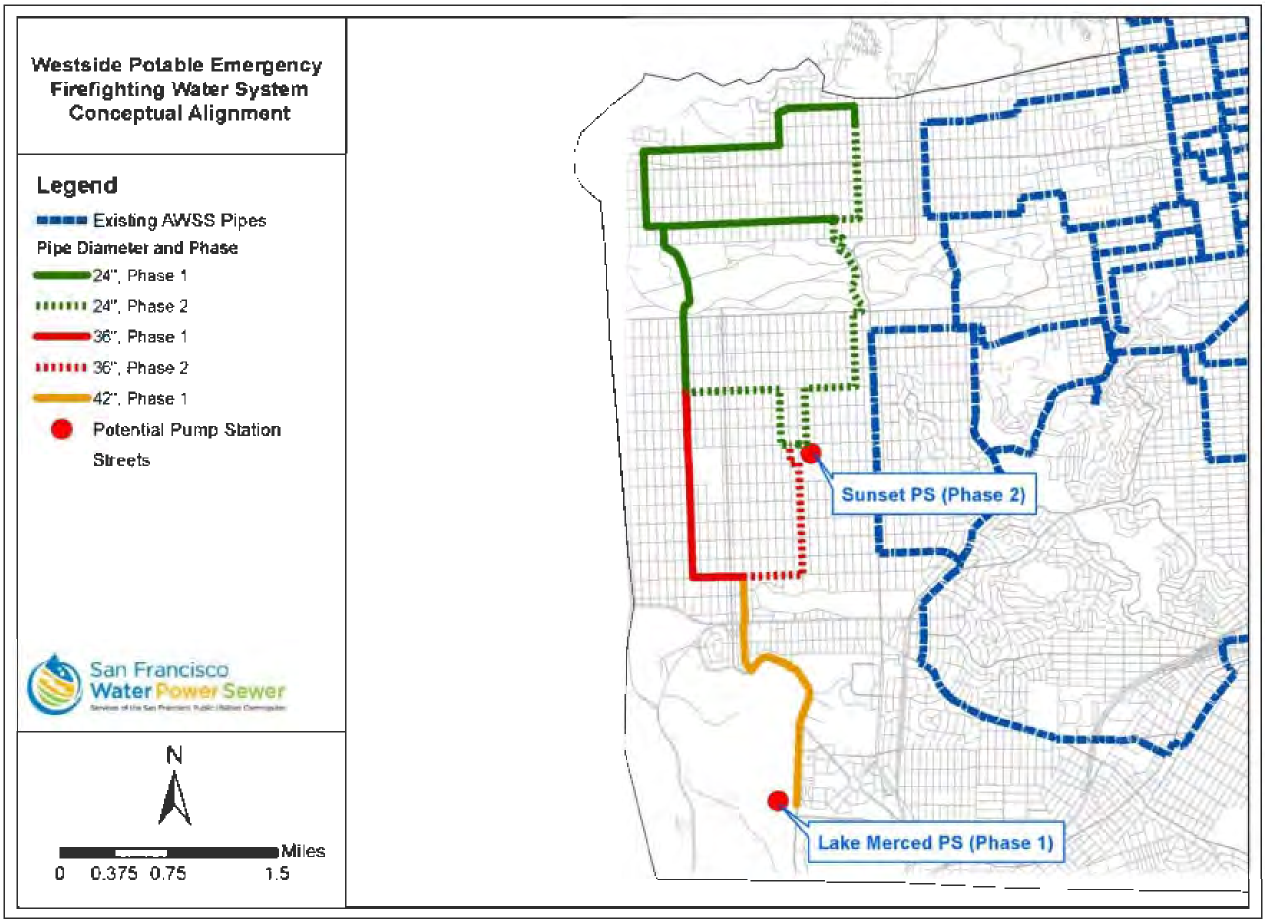
111 Meetings with SFPUC representatives. The Board of Supervisors approved the 2020-2029 ten-year Capital Plan at its April 30, 2019 meeting. See https://sfbos.org/sites/default/files/bag043019_minutes.pdf . The new ten-year Capital Plan can be found at http://onesanfrancisco.org/the-new-plan/overview .

complete the entire project. Phase 1 involves adding approximately 8.6 miles of new pipe.[112] A conceptual potential pipe alignment would extend north from Lake Merced along the west side, through the western portion of the Sunset and Richmond districts, and then have two pipelines head east, one immediately south of the Presidio and one in the southern Richmond district.[113]

A conceptual potential alignment of both Phase 1 and Phase 2 is shown in Figure 7 below:[114]

Figure 7

Conceptual Potential Alignment for Potable West Side AWSS



112 Information provided by SFPUC. The phasing and the potential, proposed or conceptual alignment discussed above and on the following pages are still in the planning stages and are subject to change. Detailed designs have not yet been completed, much technical analysis remains to be done, and the project has not yet undergone environmental reviews.

113 The current furthest west AWSS pipeline is located east of Park Presidio Boulevard.

114 Provided by the SFPUC on April 10, 2019. See footnote 121 on page 32.

The Potable AWSS pipeline network would tie into an existing, recently seismically reinforced, potable 60-inch transmission main, providing a source for normal, potable-water operations.[115] The proposed Phase 1 also includes adding a new HP pumping station at Lake Merced.[116] Although the water in Lake Merced is deemed non-potable, Lake Merced contains approximately a billion gallons or more, making it an excellent source of water for emergency firefighting purposes.[117]

The SFPUC and SFFD's future west side plans (Phase 2) include an additional 5.6 miles of pipeline for better coverage and potentially an additional pumping station at Sunset Reservoir, for another source in case of a broken pipe or other emergency.[118] However, the SFPUC and the SFFD do not anticipate having the additional approximately $120 million[119] needed to complete that portion of their plan until the next round of ESER bonds, which may not be for another five to seven years or even longer.[120]

Unfortunately, the Potable AWSS on the west side only addresses the EFWS deficits on the west side of the City. Many other City neighborhoods along its southern part, from Park Merced in the west to Visitacion Valley in the east, will be no closer to having a multi-sourced, seismically reliable HP AWSS or substantially enhancing their neighborhood's EFWS even if this westside Potable AWSS plan moves forward.

---

[115] According to the SFPUC, this transmission main connects to both (a) the Crystal Springs Reservoir in San Mateo County and to the 9'6" Crystal Springs Bypass tunnel, which is supplied by Calaveras Reservoir, San Antonio Reservoir, and the SFPUC's upcountry water sources (Hetch Hetchy, Don Pedro, etc.). These potable water sources were seismically reinforced by the SFPUC's Water System Improvement Program (WSIP), a $4.8 billion program to improve water system reliability, including seismic reliability. See SFPUC webpage on WSIP, https://www.sfwater.org/index.aspx?page=114 .

[116] Like the conceptual potential pipeline alignment, the size, location and design of any new pumping station is at present unknown and uncertain. The Civil Grand Jury understands that the Potable AWSS project is currently moving forward with design, technical studies, environmental and management reviews, but is of course also dependent upon approval of necessary funding.

[117] Information provided by SFPUC; see also V. Matuk and N. Salcedo, Lake Merced Hydrology and Water Quality, http://online.sfsu.edu/bholzman/LakeMerced/water.htm ("Estimates of the capacity of the lake also vary greatly from a low of 768 million gallons to high of 1.93 billion gallons."). The Sunset pumping station shown in the figure on the preceding page is being considered as a potential part of Phase 2.

[118] Per the SPFUC, the Sunset Reservoir Pumping Station will also be connected to a seismically reinforced, potable 54-inch transmission main. Unlike the northeast quadrant, where the AWSS pipeline system is a grid and thus provides an excellent measure of redundant support in case of a broken pipe, the proposed Potable AWSS would not be a grid. The lack of redundant pipelines creates a somewhat higher level of risk. However the use of modern ERDIP significantly reduces the risk of pipeline failure, and having redundant water sources provides additional comfort as it would enable back-feeding and reduces the risk of a potential single point of failure. 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

[119] This cost estimate is in 2018 dollars. Unless otherwise stated, all cost estimates provided by the SFPUC, SFFD and SFDPW to the Civil Grand Jury for work on the EFWS system and discussed in this report are in 2018 dollars.

[120] Even if new bonds are issued in five to seven years, design and construction of the new pipelines and new pumping station would take several more years.

The limited scope of the SFPUC's current plans is the result of budgetary constraints. The Mayor and the Board of Supervisors determine what bond proposals are placed before the voters, how frequently, and what is included. The SFPUC and the SFFD must operate within the financial constraints they are given.

The SFPUC has rough estimates showing that extending the high-pressure AWSS throughout the City–or building separate but functionally equivalent Potable AWSS systems in areas without a HP AWSS–will cost approximately $500 million in addition to the funds already targeted for Phase 1 of the Potable West Side system, as discussed above.[121] The SFPUC is not presently planning a programmatic City-wide expansion; it merely has developed a rough list of possible projects for various parts of the City that are not presently served by the HP AWSS (as well as other projects to reinforce or otherwise improve the HP AWSS system in those areas that are currently served by the HP AWSS).[122]

This roughly $500 million estimate is a huge amount of money, but as discussed in Section A above, the risk of incurring the costs from a major, inadequately-fought fire is far greater.

First and foremost is the risk to human life. In 1906, an estimated 3,000 people lost their lives, and 225,000 were left homeless. The City is obviously much better prepared today, with

---

[121] See "Candidate EFWS Projects" list dated May 8, 2019, attached as Appendix P. The actual total of projects related to system expansion is approximately $485 million, plus the $160 million for Phase 1 of the Westside project, for a total of $645 million. We have rounded the $485 million up to $500 million for the sake of simplicity and in recognition of the fact that these are all very preliminary high level estimates.

This Candidate EFWS Projects list is an internal SFPUC document: it is a list of potential project alternatives provided by the SFPUC staff to the EFWS Management Oversight Committee. The list contains potential projects that could be implemented in the future if approved by the EFWS Management Oversight Committee, if funding is made available, and if and when they go through the required environmental review. Due to the preliminary nature of the list, some of the estimated costs on this candidate project list are merely planning level estimates and would likely change if the SFPUC decided to move forward with a detailed design for a given project. Some of these projects, such as the Potable AWSS on the west side, are moving forward towards completion of design and technical studies and required environmental review based on management direction and the anticipated availability of funds. However, others are still simply candidate project alternatives that management may never proceed with.

This May 8 Candidate EFWS list also includes various proposals and potential projects to improve the seismic safety of the approximately 20 miles of HP AWSS pipes in the so-called infirm zones, as well other supply or proposed projects under consideration unrelated to any potential HP AWSS expansion. May 8, 2019 Candidate EFWS Project list attached as Appendix P; see CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 31 for a map of infirm zones.

Although the original AWSS system was designed to be seismically strong, and to survive an earthquake, it was designed shortly after the 1906 earthquake and installed by 1913. Most of the AWSS pipelines fared well during the Loma Prieta earthquake, although that was 60 miles away and not as big an earthquake as we will someday face. See, e.g., PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at pp. 9-12. Accordingly, no one knows for certain how the existing AWSS will fare in a major earthquake, especially in liquefaction areas or so-called infirm zones. The infirm zone projects, which are estimated to cost $135 million, involve installing new, backbone ERDIP pipe in each infirm zone, so that even if the existing AWSS pipe fails there will be at least one reliable major high-pressure pipeline in each area. Information provided by SFPUC; see also Appendix P.

[122] The recently approved 2020-2029 ten-year Capital Plan does not designate nearly enough money for EFWS to complete a City-wide expansion of the HP AWSS system. See http://onesanfrancisco.org/the-new-plan/overview

fire suppression systems, the existing HP AWSS, and modern building standards. Yet the 2017 North Bay fires and the 2018 Camp fire that destroyed the town of Paradise demonstrate how destructive and fast-moving fires can be under windy conditions. [123] In 1906, residents fled to the south and the west, to relatively uninhabited portions of the City that did not burn. Today, the entire City is densely populated and there would literally be no place for residents, especially our many senior citizens, to run to escape a fast-moving conflagration.

Second, in terms of property value, San Francisco has billions of dollars at risk. As discussed in Section A of this report, and in particular Table 1, a 2010 report prepared for the City estimated the range of losses due to fire following an earthquake could exceed $10 billion for a 7.9-magnitude event – in 2010 dollars. The damage estimates in Table 1 do not include business interruption losses, loss of tourism or loss of property tax revenues, all of which would undoubtedly be substantial.[124]

The substantial increase in San Francisco property values over the last decade undoubtedly increases the potential losses. In light of the dire consequences we face, the approximately $650 million price tag to expand the HP AWSS throughout the City (which includes Phase 1 of the proposed Potable AWSS on the west side), seems well worth the expenditure.

The Civil Grand Jury is not in a position to know whether each of the SFPUC's potential projects is essential, how the costs will change after detailed design work, further studies and environmental reviews, or whether more cost-efficient approaches exist. We are also not in a position to weigh the relative merits of the approximately $320 million in non-expansion-related projects on the SFPUC's Candidate EFWS Projects list.[125] But we do know that the current approach is taking too long. The SFPUC itself estimates that build-out of the AWSS "would take ~ 35 years using current funding rate assuming 5 year bond cycle."[126]

The most recent public timeline provided by the SFPUC is in CS-199, and is moot as the various projects have evolved over time. However, that timeline relies upon the issuance of

---

[123] As discussed above, wind is a major factor in fire spread. See, e.g., Kearns, F. and Moritz, M., *The Conversation* (November 16, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985; Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf at pp. 8-9, 15, 18-19. The 1923 Tokyo earthquake and subsequent fires are probably the most devastating in peacetime, with substantially greater loss of life (an estimated 140,000 killed) than the 1906 earthquake. See Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019 at pp. 1-2, 19-23; see also Great Tokyo Earthquake of 1923, at http://factsanddetails.com/japan/cat26/sub160/item2226.html. Among the reasons for the devastation in Tokyo were winds of approximately 28 miles per hour at the time of the earthquake, with increasing wind throughout the day. *Id.*

[124] See CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 95-97.

[125] See May 8, 2019 Candidate EFWS Projects list, attached as Appendix P.

[126] SFPUC Emergency Firefighting Water System, Management Oversight Committee presentation dated March 4, 2019, at p. 32. The City is not committed to a five year bond cycle, so it could be even longer, although the increased level of funding in the proposed 2020 ESER bond indicates that things may be moving more rapidly.

ESER bonds every five to seven years, through and including a 2045 bond issuance, such that work would not be completed until 2049.[127]

Either way, this means that areas of our City, such as District 11, would not be as well protected as other areas, and would not have a HP AWSS in place if, as predicted by the USGS, a major earthquake hits the Bay Area before 2043.

Accordingly, the Civil Grand Jury recommends a major acceleration of these efforts, such that all areas of the City are protected by a seismically sound, multi-sourced, HP emergency water firefighting system within 15 years, i.e., by no later than 2034.

H. The Bottom Line: Act Fast, but Ensure Redundancy

Among the most important factors in designing an EFWS is redundancy. This is true whether the City chooses to extend the existing AWSS or to adopt a different approach. Regardless of the specific plan, there must be multiple, redundant sources of water such that if one source fails or a pipe breaks, firefighters have other means to obtain necessary water supplies.

In the Loma Prieta earthquake the Marina district was saved by the combination of the PWSS and a fireboat, or "the backup to the backup."[128] Unpredictable stuff happens, especially in a major earthquake, and redundancy is necessary.[129] This means not just looped pipe systems but also multiple sources of water. One of the great ironies of the 1906 earthquake is that San Francisco is surrounded by water yet it burned due to a lack of water.

The original HP AWSS was designed with both a redundant water supply and a gridded main system.[130] The system in the northeast quadrant of the City "seeks high post-earthquake

---

[127] Figure 5-1, *Preferred Alternative Planning Level Schedule,* from CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 71, and attached as Appendix R.

[128] See Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992); Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC; Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018).

[129] See, e.g., Metcalf & Eddy, http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00 at p. 20; CS-199, at p. 11 ("Multiple redundancies in fire water supply systems are necessary."), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

[130] 2018 Westside Options Analysis, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 37.

reliability via multiple sources of supply."[131] Those sources include two above-ground storage tanks, a reservoir, two salt-water pumping stations, plus several fire boat manifolds if needed.[132]

Many citizens have called for installing a salt-water pump station or stations on the west side, arguing that the ocean provides an unlimited source of water.[133] A salt-water pump station north of Golden Gate Park would also provide geographic diversity of water sources, as the other proposed pumping stations and HP water sources are all south of Golden Gate Park. Dr. Scawthorn, the City's consultant, has asserted that a salt-water pump station on the west side "would be very beneficial."[134]

The Civil Grand Jury recognizes that this may raise environmental and other issues, and may or may not be necessary in light of the potential use of Lake Merced.[135] Nevertheless, the Civil Grand Jury strongly believes in having redundant and geographically diversified water sources, and developing a robust water source in the northwest quadrant of the City seems to us to be beneficial. Other areas of the City have added protection from the SFFD's four fireboats, which can be connected to the PWSS to provide an alternate water supply, as in Loma Prieta. Unfortunately, fireboats are not designed to work in the open water of the Pacific Ocean, and PWSS hose tenders cannot practically drive onto beaches to draft water from the ocean.[136] For these reasons, a salt-water pumping station on the west side seems particularly appropriate.

The need for further EFWS projects is underscored by two additional considerations, discussed more fully below. First, the reliability scores cited in the SFPUC's consultant's reports over-state how effective our current plans are likely to be upon completion. Second, these scores – and our safety – are predicated on being able to properly maintain and operate the existing AWSS assets, especially critical assets, so they are ready when needed.

---

[131] Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740 at p. 2.

[132] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 7-8.

[133] Pendergast, T, *Plan to Protect Neighborhood Abandoned*, Richmond Review (November 2017), https://sfrichmondreview.com/2017/11/02/plan-to-protect-neighborhoods-abandoned/ ; Fracassa, D, *SF Moves to Build Water System to Fight Fires for When the Worst Hits*, San Francisco Chronicle (February 11, 2018), https://www.sfchronicle.com/politics/article/SF-moves-to-build-water-system-to-fight-fires-12605847.php ; Doudiet, T., *Commentary–Sound the Fire Alarm!*, Richmond Review / Sunset Beacon (November 3, 2017), https://sfrichmondreview.com/2017/11/03/commentary-thomas-w-doudiet/ ; Wuerfel, N., *Commentary–SFPUC Misleads Public*, Richmond Review / Sunset Beacon (November 13, 2018), https://sfrichmondreview.com/2018/11/13/commentary-nancy-wuerfel-2/ .

[134] Scawthorn 2018 memo, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740, at p. 7.

[135] Any plan to add a salt-water pump station would need to be responsive to concerns about reducing or even eliminating if possible any impacts on marine life.

[136] Information provided by the SFFD.

I. Current FRA Reliability Scores Promote Overconfidence

The SFPUC's and the SFFD's goal is to provide a certain Level of Service (LOS) for emergency firefighting water supply throughout the City. In particular, the SFPUC has articulated the following LOS objective:

> AWSS will reliably provide water to supply the "probable fire demands" after a magnitude 7.8 San Andreas earthquake. Each FRA will have a minimum of 50% reliable water supply to meet probable fire demands. The Citywide average will be a minimum of 90% reliable water supply to meet probable fire demands.[137]

The Civil Grand Jury agrees with the goal that the City should be prepared to fight fires following a magnitude 7.8 San Andreas earthquake. However, we are concerned with the current measures of "reliability." As discussed below, the "reliability scores" being used by the City create a misleadingly optimistic impression and imply a false precision.

As explained in CS-199, "[i]n the context of this study, reliability is defined as the percentage of the water demand met by AWSS high-pressure system and other sources."[138] Put differently, the reliability score methodology "does not actually represent an estimate of reliability but is a ratio of the EFWS capacity and demand."[139]

The ratio of capacity and demand is a useful measure, but the scores being used are overly optimistic in that the estimated "demand" used is the *median* estimated demand.[140] By definition, half the time one would expect worse conditions and therefore greater demand for water to fight fires. Using a demand estimate that is by definition insufficient half the time is not truly preparing for a repeat of the 1906 earthquake.

The problem of using the median demand is exacerbated by the wide variation in the potential number of fires, fire size, and water demands.[141] As just one example, San Francisco was lucky that there was little to no wind during the Loma Prieta earthquake. Yet as any resident of our City knows, the City often experiences significant wind conditions.

Another problem with the reliability scores is that they ignore where in the FRA a fire is, as well as the size of each FRA. For example, the southeastern portion of the City has several geographically large FRAs.[142] Although water may be able get to the northern part of a particular FRA, the southern part of that FRA may not be as well protected. In addition, the

---

137 2018 Westside Options Analysis, at p. 7, https://www.sfwater.org/modules/showdocument.aspx?documentid=117400 ; CS-199, at p. 102, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 .

138 CS-199, at p. ix, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

139 Scawthorn 2018 memo, at p. 6, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

140 *Id.*, at p. 5.

141 *Id.*, at p. 5.

142 See map of FRAs, attached as Appendix J.

demand represents the water supply need for an entire FRA, and the scores assume that the SFFD "would utilize the Portable Water Supply System (PWSS) or engine relays to distribute the water supply within the FRA to the actual ignition locations."[143] This is an unrealistic assumption, given the City's current inventory of only five old PWSS hose tenders, and the likely demand on fire engines in a major earthquake with a multitude of fires.

The SFPUC is in the process of analyzing potential EFWS demands on a more detailed level, and has shared some of the preliminary results with the Civil Grand Jury. The Civil Grand Jury supports this approach and recommends that the SFPUC continue its efforts to make a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA.

J. Maintenance and Training Issues

1. Maintenance Issues

AWSS assets must be well maintained in order to be operational during an emergency. A 2014 study prepared for the SFPUC by its outside consultants AECOM/AGS, a Joint Venture found "maintenance deficiencies" because routine maintenance plans had not been established for all AWSS assets. Instead, maintenance was being performed on an "as needed" basis.[144]

During our investigation, the Civil Grand Jury learned that the SFPUC has not developed a number of the routine maintenance plans recommended in the 2014 report.[145] The SFPUC assured us that it has done a good job at maintaining AWSS, and disagrees with some of the recommendations in that 2014 report. Nevertheless, the SFPUC has yet to develop routine maintenance plans for some important AWSS assets.

As an example, the report recommended the SFPUC adopt plans to regularly exercise all AWSS system valves.[146] In response, the SFPUC expressed a "goal" to exercise critical valves every two years.[147] It has defined "critical valves" to include only 66 out of the approximately 1,685 valves in the HP AWSS system.[148] SFPUC personnel acknowledge that its current approach is not a "best practice," and that valves should likely be exercised on a regular basis. SFPUC personnel also acknowledge that its definition of what constitutes a "critical" valve requiring more frequent testing is probably too narrow.[149]

[143] 2018 Westside Options Analysis, at p. 37, https://www.sfwater.org/modules/showdocument.aspx?documentid=11740.

[144] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at pp. 15-16, 24-26.

[145] Information provided by SFPUC.

[146] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 at p. 25.

[147] Information provided by SFPUC.

[148] Ibid.

[149] Interviews with SFPUC personnel.

In another instance, the 2014 report recommended that all suction connections be cleaned on a regular basis.[150] The SFPUC noted that suction connections were cleaned in 2014, but that the agency had not adopted a routine maintenance plan.[151]

Now that the SFPUC has had time to focus on the condition of the AWSS, the Civil Grand Jury recommends that it utilize "best practices" for the maintenance of AWSS assets, including valves and suction connections, and that the SFPUC, with the help of the SFFD, redefine which valves in the system are "critical," and, therefore, require more attention and priority in its maintenance plans.

2. Coordinated Training and Drills

Another recommendation in CS-199, the 2014 report prepared for the SFPUC by its outside consultant AECOM/AGS, a Joint Venture, was that the SFPUC "prepare an emergency response program and conduct training exercise [sic]."[152] The report also recommended that SFPUC staff be trained on the AWSS system, including "communications, operational strategies," and "emergency response requirements."[153] Both of these recommendations were given "high" priority, and assessed to entail "low" ongoing cost.[154]

In 2015, the SFFD and the SFPUC entered into a Memorandum of Understanding ("MOU") regarding the operation and maintenance of water-supply systems related to fire suppression.[155] In Section C, entitled "Coordinated Emergency Operations Between the SFWD and SFFD", the MOU requires that "All members of the SFWD … must be trained in the AWSS and the AWSS SCADA system along with the SFFD Water Supply manual."[156] The MOU also specifies that "[t]he SFFD and the SFWD will collaborate for annual training on system operations and appropriate shut-down procedures during and after firefighting operations."[157] The MOU, therefore, requires the SFPUC and the SFFD to coordinate to train all SFWD personnel on the

---

[150] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. 15-16, 24-26, 88, 135. There are approximately35 suction connections along the bay that allow engine pumpers to draw by suction from the bay, and a suction line with low-pressure hydrants along Fulton St. that draws from lakes in Golden Gate Park. Some of these suction connections are located on the bottom of the Bay and can be filled with silt or marine organisms that would interfere with water pumping.

[151] Interviews with SFPUC personnel.

[152] CS-199, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055 , at pp. x, 88.

[153] Ibid.

[154] Ibid.

[155] Memorandum of Understanding Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.

[156] *Id.*, at Section C.1.

[157] *Id.*, at Section C.3.

AWSS system and on other available water supply sources to fight fires in emergencies. It also requires coordinated, *annual* training on emergency operation of the system.

In 2017, the SFPUC updated its Emergency Response Plan.[158] A review of the Plan, however, offers little detail on the type of exercise conducted or how often exercises might be conducted in the future.[159] Similarly, although CS-199 identified the need for emergency training and a training exercise, CS-199 did not provide details as to the scope or frequency of any training exercises.

In the past several years the SFFD and SFPUC have taken advantage of many opportunities for joint training concomitant with their joint operation and maintenance of AWSS assets. For example, the two agencies test Pump Stations 1 and 2, on a monthly basis. The agencies also meet after greater-alarm fires to discuss coordination, and how to improve operations in the field. In addition, the SFFD and SFPUC have, on occasion, conducted joint emergency trainings involving earthquake disaster scenarios. In 2018, for example, they engaged in a "tabletop exercise" where high-level staff members were asked to respond to a hypothetical earthquake scenario to test their understanding of the emergency command structure.

The SFPUC anticipates that it will repeat this joint tabletop exercise at least every other year, and that it will conduct larger-scale simulations of post-earthquake emergency response procedures with the SFFD within the next two years. There is no formal document, however, outlining specific joint exercises or drills to be conducted by the two agencies.

In the 1989 Loma Prieta earthquake, human error was cited by some as a reason why AWSS was not available to fight fires in the Marina.[160] A 2011 survey of California fire and water agencies concluded, generally speaking, that "[f]ire and water department liaison is not very good" and that "[e]mergency firefighting water supply is not a focus."[161] Moreover, the report found that fire departments are not "regularly drilled for the very difficult task of moving water from the alternative water sources to the fire scene."[162]

The Civil Grand Jury believes that the City would be well served if the SFPUC and SFFD worked together to design and implement annual "hands-on" drills to make certain that their staff is prepared to use all available resources to fight fires after an earthquake. Accordingly, the Civil Grand Jury recommends that the MOU between the SFPUC and the SFFD be amended to include a more detailed roadmap for emergency response exercises to be held, City-wide,

[158] Information provided by SFPUC.

[159] City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

[160] See, e.g., Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992).

[161] PEER 2011, Water Supply Following Earthquake, https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf at p. 75. By contrast, both the SFPUC and the SFFD have indicated that they currently enjoy excellent communication.

[162] *Id.*

annually. In addition to tabletop scenarios, these exercises should include hands-on field testing in the operation of AWSS assets and PWSS units.

CONCLUSION

Over one hundred years ago, our City was destroyed by fire following an earthquake. Luckily, our predecessors learned from this catastrophe. They aggressively undertook to design, fund, and quickly build a supplemental emergency water supply system that provided firefighters with multiple options if one or more water sources were compromised – "belt and suspenders." They gave us an excellent emergency water system to protect our wonderful, seismically vulnerable City.

We have, however, long outgrown the protective reach of the system we inherited. Now it is our turn to aggressively implement measures to extend protections to reach all San Francisco neighborhoods. The time to act is now, before it is too late.

FINDINGS

F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.

F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.

F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.

F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.

F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.

F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.

F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.

F8. Redundancy is an important feature of an emergency firefighting water system.

F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.

F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.

F11. The City does not have a timeline to fund and complete development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.

F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.

F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.

RECOMMENDATIONS

R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.

R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.

R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.

R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.

R6. The SFPUC, the SFFD and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.

R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.

R9. By no later than December 31, 2020 the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.

R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the Civil Grand Jury requests responses as follows:

From the following City and County agencies and departments within 60 days:

- Office of the Mayor
  - Findings 4, 5, 6, and 11
  - Recommendations 1, 2, 4, and 8
- General Manager, San Francisco Public Utilities Commission
  - Findings 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13
  - Recommendations 1, 2, 6, 7, 9, and 10
- Chief, San Francisco Fire Department
  - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 13
  - Recommendations 1, 2, 4, 5, 6, 7, and 10
- Office of the City Administrator
  - Findings 6 and 11
  - Recommendations 1, 2 and 8
- Chief Resilience Officer, Office of the City Administrator
  - Findings 6 and 11
  - Recommendations 1, 2 and 8
- Director, San Francisco Department of the Environment
  - Recommendation 6
- Budget and Legislative Analyst Office, Board of Supervisors
  - Findings 6 and 11
  - Recommendation 3

From the Board of Supervisors and other governing bodies within 90 days:

- Board of Supervisors
  - Findings 4, 5, 6 and 11
  - Recommendations 1, 2, 3, 4, 6, 7, and 8
- San Francisco Public Utilities Commission
  - Findings 2, 4, 5, 6, 8, 9, 10, 11, and 12
  - Recommendations 1, 2, 6, 7, 9, and 10
- San Francisco Fire Commission
  - Findings 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11
  - Recommendations 1, 2, 4, 5, 6, 9 and 10

GLOSSARY AND TABLE OF ACRONYMS AND ABBREVIATIONS

ATC	Applied Technology Council. A non-profit corporation whose mission is to develop and promote state-of-the-art, user-friendly engineering resources and applications for use in mitigating the effects of natural and other hazards on the built environment, and which prepared reports in 2010 for the City under the CAPSS Project.
AWSS	Auxiliary Water Supply System. An independent emergency firefighting system built after the 1906 earthquake. The AWSS at present consists of approximately 135 miles of high-pressure (HP) pipelines, 230 cisterns, two above-ground storage tanks, a reservoir, and two salt-water pumping stations. The AWSS HP pipelines can supply water at pressures up to 300 psi via hydrants with black, red or blue tops, depending upon location.
CAPSS	Community Action Plan for Seismic Safety. According to the CAPSS website, CAPSS was started in the Department of Building Inspection beginning in 1998, and was a nine-year, $1 million study to understand, describe, and mitigate the risk San Francisco faces from earthquakes. CAPSS produced an extensive analysis of potential earthquake impacts as well as community-supported recommendations to mitigate those impacts.
CCSF	City and County of San Francisco
CDD	City Distribution Division. The division of the SFPUC responsible for maintenance of both the MWSS and the AWSS.
DWSS	Domestic Water Supply System, also referred to as the Municipal Water Supply System, MWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS (DWSS) is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
ERDIP	Earthquake Resistant Ductile Iron Pipe. A modern type of pipe that is believed to be earthquake resistant and that has been subjected to several major earthquakes in Japan without any observed failures.
EFWS	Emergency Firefighting Water System. All emergency sources of water and the means for delivering them. Includes HP AWSS pipelines, cisterns, PWSS and fireboats.
ESER	Earthquake Safety and Emergency Response. ESER bonds are generally issued every five to seven years to address to fund repairs and improvements to infrastructure that allow the City to respond more quickly and effectively to a major earthquake or other disaster.

FRA	Fire Response Area. The SFFD divides the City into 46 areas for initial alarm response, referred to as Fire Response Areas or FRAs.
HP	High-pressure
LOS	Level of Service
MOU	A Memorandum of Understanding between the SFPUC and the SFFD Regarding Operation and Maintenance of San Francisco Water Supply Systems Related to Fire Suppression, dated June 1, 2015 and signed in September 2015.
MWSS	Municipal Water Supply System, also referred to as the Domestic Water Supply System, DWSS, or the potable water system. The SFPUC supplies potable (drinking) water throughout the City. The MWSS is a low-pressure system, typically ranging between 50 and 70 psi. The MWSS is also the primary supply for firefighting via fire hydrants with white tops.
PEER	Pacific Earthquake Engineering Research Center
PSI	Pounds per square inch
PWSS	Portable Water Supply System. A mobile above-ground large (five-inch) diameter hose system transported on trucks (hose tenders). A hose tender truck can carry approximately 5000 feet of five-inch hose. A more thorough description is provided at pages 23-26. The PWSS is not to be confused with the flexible water supply system, an idea for 12-inch diameter hoses that was abandoned as impractical.
SCADA	Supervisory Control and Data Acquisition. A computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
SFDPW	San Francisco Department of Public Works
SFFC	San Francisco Fire Commission
SFFD	San Francisco Fire Department
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
USGS	United States Geological Survey
WSIP	Water System Improvement Program. The WSIP is a $4.8 billion dollar, multi-year program to upgrade the SFPUC's regional and local water systems. The WSIP, which is over 96% complete, is one of the largest water infrastructure

programs in the nation and the largest infrastructure program ever undertaken by the City.

APPENDICES

A. Table of Findings and Recommendations
B. Table of Findings with Required Responses
C. Table of Recommendations with Required Responses
D. List of Reports Specifically Focusing on the City's AWSS or PWSS
E. List of Additional Reports Reviewed
F. USGS, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf
G. USGS, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf
H. Map of Existing EFWS, with HP AWSS, Cisterns and other Assets
I. Map of Existing HP AWSS system
J. Map of SFFD Fire Response Areas
K. Abstract (page 2) from Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco, http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf
L. Analysis by the Ballot Simplification Committee of 1986 Proposition A.
M. San Francisco Fire Commission Resolution 2010-01, dated January 14, 2010, https://sf-fire.org/sites/default/files/FileCenter/Documents/2446-Resolution%202010-01%20PWSS%20Grant%20Funding.pdf
N. SFPUC 2017 FAQ, https://sfwater.org/modules/showdocument.aspx?documentid=11507 printed March 6, 2019
O. SFPUC EFWS 2010 and 2014 ESER bond project status as of February 26, 2019
P. SFPUC Candidate EFWS Project list dated May 8, 2019
Q. Fire Dept.'s Ace in the Hole, San Francisco Independent, January 31, 1990
R. Figure 5-1, *Preferred Alternative Planning Schedule*, from CS-199, at p. 71, https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055.

APPENDIX A
TABLE OF FINDINGS AND RECOMMENDATIONS

Findings	Recommendations
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco. F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake. F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake. F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake. F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake. R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034. R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short term and the long term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.

Findings	Recommendations
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced seismically safe emergency water supply can be developed in those areas.	R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.
F8. Redundancy is an important feature of an emergency firefighting water system. F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.
F10. The "reliability scores" being used by the SFPUC impart an overly optimistic impression of the protection provided.	R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above-the-median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.

Findings	Recommendations
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City. F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply. F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034.
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are "critical" and therefore require increased attention.	R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.

APPENDIX B
TABLE OF FINDINGS WITH REQUIRED RESPONSES

Findings	Required Responses
F1. Fires resulting from an earthquake represent a significant risk of widespread damage and potential loss of life in San Francisco.	• Chief, San Francisco Fire Department • San Francisco Fire Commission • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F2. The municipal water supply system (MWSS) is highly vulnerable to damage from a major earthquake and is not a reliable source for water supply for firefighting after a major earthquake.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Chief, San Francisco Fire Department • San Francisco Fire Commission
F3. Approximately 30 cisterns have recently been added with funds from ESER bonds, but cisterns only have up to about an hour of water supply and thus do not provide sufficient water for fighting fires following a major earthquake.	• Chief, San Francisco Fire Department • San Francisco Fire Commission
F4. The City's high-pressure emergency water supply system, known as the Auxiliary Water Supply System (AWSS), does not cover large parts of Supervisorial Districts 1, 4, 7 and 11, roughly one-third of the City's developed area. As a result, these districts are not adequately protected from fires after a major earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F5. A high-pressure, multi-sourced, seismically safe emergency firefighting water supply will be costly but is essential to protect the City.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F6. Unless the City increases funding levels, it will be several decades (i.e., after the USGS predicts one or more major earthquakes will occur) before the southern parts of the City have a high-pressure, multi-sourced, seismically safe emergency firefighting water supply.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F7. The existing Portable Water Supply System (PWSS) inventory is inadequate. Investing in more PWSS hose tenders would provide a relatively quick, cost-effective interim means to improve protection of the southern and western parts of the City until a high-pressure, multi-sourced, seismically safe emergency water supply can be developed in those areas.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F8. Redundancy is an important feature of an emergency firefighting water system.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F9. Current plans to extend protections to the western part of the City do not include any high-pressure water sources north of Golden Gate Park.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

Findings	Required Responses
F10. The “reliability scores” being used by the SFPUC impart an overly optimistic impression of the protection provided.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
F11. The City does not have a timeline to fund and complete the development of a high-pressure, multi-sourced, seismically safe emergency water supply for all parts of the City, including poor neighborhoods that historically have not been as well protected as the downtown business district and many richer neighborhoods.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator • Budget and Legislative Analyst Office, Board of Supervisors
F12. The SFPUC has not developed a number of the routine maintenance plans recommended in a 2014 report (CS-199), and has not adequately defined which AWSS valves are “critical” and therefore require increased attention.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission
F13. In the 2015 MOU between the SFFD and the SFPUC, the two agencies agreed to conduct joint AWSS trainings annually, but there is no formal protocol outlining specific joint AWSS exercises or drills using hypothetical disaster scenarios, such as a major earthquake.	• General Manager, San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department

APPENDIX C
TABLE OF RECOMMENDATIONS WITH REQUIRED RESPONSES

Recommendations	Required Responses
R1. By no later than December 31, 2020, the Mayor, the SFPUC, the SFFD and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R2. The plan discussed in Recommendation R1 should include a detailed proposal, including financing sources, for the installation within 15 years of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, i.e., by no later than June 30, 2034.	• Office of the Mayor • Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator
R3. The Board of Supervisors should direct the Budget and Legislative Analyst to study through an equity lens and issue a report to the Board regarding (a) which areas of the City do not have sufficient water supplies for the anticipated demand for water to fight fires following a major earthquake similar in magnitude to the 1906 earthquake, and (b) options to address the issue in both the short-term and the long-term. The Board should issue its request by no later than December 31, 2019, and the Budget and Legislative Analyst should complete its report by no later than December 31, 2020.	• Board of Supervisors • Budget and Legislative Analyst Office, Board of Supervisors

Recommendations	Required Responses
R4. As interim measure, by no later than June 30, 2021, the City should purchase the 20 new PWSS hose tenders being requested by the SFFD, to replace and expand its currently inadequate inventory.	• Office of the Mayor • Board of Supervisors • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R5. The SFFD should strategically locate the majority of the PWSS hose tenders in areas that at present only have low-pressure hydrants and/or cisterns.	• Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R6. The SFPUC, the SFFD, and the SF Department of the Environment should study adding salt-water pump stations to improve the redundancy of water sources, especially on the west side. Findings and recommendations from this study should be presented to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission • Director, San Francisco Department of the Environment
R7. The SFPUC should (a) continue its efforts to complete a more detailed analysis of emergency firefighting water needs (including above the median needs) by neighborhood, and not just by FRA, and (b) present a completed analysis to the Board of Supervisors by no later than June 30, 2021.	• Board of Supervisors • General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department
R8. By no later than June 30, 2022, the Mayor and the Board of Supervisors should analyze whether to propose a separate bond for the development of a high-pressure, multi-sourced, seismically safe emergency water system for those parts of the City that don't currently have one, with a target date of completing construction by no later than June 30, 2034	• Office of the Mayor • Board of Supervisors • Office of the City Administrator • Chief Resilience Officer, Office of the City Administrator

Recommendations	Required Responses
R9. By no later than December 31, 2020, the SFPUC, with the advice and subject to the approval of the SFFD, should (a) implement "best practices" for the maintenance of AWSS assets, and (b) redefine which AWSS valves in the system are "critical," and, therefore, require more attention and priority in the SFPUC's maintenance plans.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission
R10. By no later than June 30, 2020, the 2015 MOU between the SFPUC and the SFFD should be amended to include a detailed roadmap for annual emergency response exercises, including simulated disaster and earthquake drills involving the AWSS and the PWSS.	• General Manager, San Francisco Public Utilities Commission • San Francisco Public Utilities Commission • Fire Chief, San Francisco Fire Department • San Francisco Fire Commission

APPENDIX D
List of Reports Specifically Focusing On the City's AWSS or PWSS

2002-2003 Civil Grand Jury for the City and County of San Francisco, Keeping the Faucets Flowing: Water Emergency Preparedness In San Francisco (June 2003), http://civilgrandjury.sfgov.org/2002_2003/Keeping_the_Faucets_Flowing_Water_Emergency.pdf

AECOM / AGS, a Joint Venture, CS-199 Planning Support Services for Auxiliary Water Supply System (AWSS) Project Report (Final Report) (February 2014) ("CS-199"), https://www.sfwater.org/Modules/ShowDocument.aspx?documentid=5055

AECOM / AGS, JV, Auxiliary Water Supply System Planning Study Summary, prepared for SFPUC (February 2014), https://sfwater.org/Modules/ShowDocument.aspx?documentid=4907

AECOM / WRE, a Joint Venture, CS-229 Task 16 and 19, Emergency Firefighting Water System (EFWS) Spending Plan for the Earthquake Safety Emergency Response (ESER) 2014 Bond (November 2015) ("CS-229"), https://sfwater.org/Modules/ShowDocument.aspx?documentid=8246

AECOM, Westside Emergency Firefighting Water Systems Options Analysis Report (January 5, 2018) ("2018 Westside Options Analysis"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Earthquake Safety and Emergency Response (ESER) Bond, Citizens' General Obligation Bond Oversight Committee Reports & Quarterly Reports, found online at http://www.sfearthquakesafety.org/eser-reports.html

Madsen, M., Reports on an Auxiliary Water Supply System for Fire Protection for San Francisco, California (1908), https://sfpuc.sharefile.com/share/view/4743f327acfd4ba7

Metcalf & Eddy / AECOM, Auxiliary Water Supply System (AWSS) Study, prepared for Capital Planning Committee, City and County of San Francisco (2009) ("Metcalf & Eddy"), http://s3-us-west-2.amazonaws.com/ucldc-nuxeo-ref-media/b2754026-dded-4ee6-b24c-2cf837f3bc00

San Francisco Department of Public Works, Auxiliary Water Supply System (AWSS) Pipeline Assessment, Earthquake Safety and Emergency Response Bond 2010, prepared for SFPUC (May 11, 2017), https://sfpuc.sharefile.com/share/view/684778cd4b46406e

Scawthorn, C., January 5, 2018 memorandum to D.Myerson & S.Huang of SFPUC re Review of "Westside Emergency Firefighting Water System Options Analysis", (Scawthorn 2018 memo"), https://www.sfwater.org/modules/showdocument.aspx?documentid=11740

Scawthorn, C. and Blackburn, F., Performance of the San Francisco Auxiliary and Portable Water Supply Systems in the 17 October 1989 Loma Prieta Earthquake, presented at Fourth U.S. National Conference on Earthquake Engineering May 20-24, 1990, and provided by SFPUC

APPENDIX E
List of Additional Reports Reviewed

Applied Technology Council (ATC) ATC 52-1, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, Potential Earthquake Impacts, prepared for the Department of Building Inspection, CCSF, under the Community Action Plan for Seismic Safety (CAPSS) Project (2010)(“ATC 52-1, Potential Earthquake Impacts”), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9753-atc521.pdf

Applied Technology Council (ATC) ATC-52-2, Here Today–Here Tomorrow: The Road to Earthquake Resilience in San Francisco, A Community Action Plan for Seismic Safety, prepared for the Department of Building Inspection, CCSF, under the (CAPSS) Project (2010), https://sfgov.org/esip/sites/default/files/FileCenter/Documents/9757-atc522.pdf

Aster, R., California’s other drought: A major earthquake is overdue, *The Conversation* (January 30, 2018), https://theconversation.com/californias-other-drought-a-major-earthquake-is-overdue-90517

Blackburn, F., Report on Firefighting Requirements Following Earthquake and Current Proposals by the SFPUC (2018)

City Distribution Department (CDD) Earthquake Response Plan (updated December 2017), https://sfpuc.sharefile.com/share/view/s77bd1c3318e4355b

Eidinger, J. Editor, Fire Following Earthquake, Revision 11 (2004), http://home.earthlink.net/~eidinger , downloaded from the internet on March 6, 2019

Himoto, K., Akimoto, Y., Hokugo, A., and Tanaka, T., Risk and Behavior of Fire Spread in a Densely-built Urban Area, International Association for Fire Safety Science (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1000.9412&rep=rep1&type=pdf

Johnson, L. and Mahin, S., The 6.0 M_W South Napa Earthquake of August 24, 2014: A Wake-up Call for Renewed Investment in Seismic Resilience across California, Pacific Earthquake Engineering Research Center prepared for the California Seismic Safety Commission, CSSC Publication 16-03, PEER Report No. 2016/04 (2016), https://ssc.ca.gov/forms_pubs/cssc_603peer201604_final_7_20_16.pdf

Kearns, F. and Moritz, M., How fierce fall and winter winds help fuel California fires, *The Conversation* (16 November, 2018), https://theconversation.com/how-fierce-fall-and-winter-winds-help-fuel-california-fires-106985

Li, W., Wang, D., and Zhao, K., Research on Urban Post-earthquake Fire, presented at Sixth China-Japan-U.S. Trilateral Symposium on Lifeline Earthquake Engineering (2013) https://ascelibrary.org/doi/10.1061/9780784413234.008

Moritz, M., *California Needs To Rethink Urban Fire Risk, Starting with Where It Builds Houses*, in The Conversation (December 13, 2017), https://theconversation.com/california-needs-to-rethink-urban-fire-risk-starting-with-where-it-builds-houses-88825

O'Rourke, T.D., Lessons Learned For Lifeline Engineering From Major Urban Earthquakes, presented at Eleventh World Conference on Earthquake Engineering (1996)

San Francisco Fire Department Emergency Operations Plan

San Francisco Fire Department Water Supplies Manual (2008), http://ufsw.org/pdfs/water_supplies_manual.pdf

Scawthorn, C., Coordinated Planning and Preparedness for Fire Following Major Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2013), https://ssc.ca.gov/forms_pubs/webpeer-2013-23-scawthorn.pdf

Scawthorn, C., Water Supply In Regards to Fire Following Earthquakes, Pacific Earthquake Engineering Research Center, College of Engineering, University of California, sponsored by the California Seismic Safety Commission, Berkeley (2011) ("PEER 2011, Water Supply Following Earthquake"), https://peer.berkeley.edu/sites/default/files/webpeer-2011-08-charles_scawthorn.pdf

Scawthorn, C., SPA Risk LLC, *Analysis of Fire Following Earthquake Potential for San Francisco, California*, prepared for the Applied Technology Council on behalf of the Department of Building Inspection City and County of San Francisco (October 2010 Rev. 1) ("Scawthorn 2010, Analysis of Fire Following Earthquake for San Francisco"), http://www.sparisk.com/documents/SPASanFranciscoCAPSSFireFollowingEarthquakeOct2010.pdf

Scawthorn, C., *Fire following earthquake: Estimates of the conflagration risk to insured property in greater Los Angeles and San Francisco*, All-Industry Research Advisory Council, Oak Brook, Ill. (1987), http://www.sparisk.com/documents/AIRACFFEs.pdf or for a copy, click here.

Scawthorn, C., Fire Following Earthquake Aspects of the Southern San Andreas Fault M_W 7.8 Earthquake Scenario. *Earthquake Spectra* 27 (2), 419-441 (2011), http://www.sparisk.com/pubs/Scawthorn-2011-ShakeOut-FFE.pdf

Scawthorn, C., *Fire Following Earthquake, Supplemental Study for the ShakeOut Scenario.* The ShakeOut Scenario: U.S. Geological Survey Open File Report 2008-1150, California Geological Survey Preliminary Report 2, version 1.0, U.S. Geological Survey Circular 1324, California Geological Survey Special Report 207 version 1.0. U. S. Geological Survey and California Geological Survey, Pasadena (2008), Scawthorn-2008-ShakeOut-FFE

Scawthorn, C., Fire Following the M_w 7.0 HayWired Earthquake Scenario, in Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Engineering Implications*. Scientific Investigations Report 2017–5013–I–Q. Reston, VA: United States Geological Survey, ch. P, pp. 367-400 (2018), at https://doi.org/10.3133/sir20175013 and www.sparisk.com/pubs/HayWired-2018-vol2.pdf

Scawthorn, C., O'Rourke, T. D. & Blackburn, F. T., *The 1906 San Francisco Earthquake and Fire---Enduring Lessons for Fire Protection and Water Supply*. Earthquake Spectra, Volume 22, S135-S158 (2006) ("Scawthorn, O'Rourke & Blackburn, 1906 Lessons"), http://www.sparisk.com/documents/06Spectra1906SFEQandFire-EnduringLessonsCRSTDOFTB.pdf.

Scawthorn, C., Porter, K., and Blackburn, F., Performance of Emergency-Response Services After the Earthquake, chapter in The Loma Prieta, California, Earthquake of October 17, 1989, Marina District, T.D. O'Rourke editor, USGS Professional Paper 1551-F (1992)

U.S. Geological Survey, UCERF3: A New Earthquake Forecast for California's Complex Fault System, Fact Sheet 2015-3009 (2015) https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf

U.S. Geological Survey, Earthquake Outlook for the San Francisco Bay Region 2014–2043, Fact Sheet 2016-3020 (2016) (version 1.1), https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf

Appendix F

USGS science for a changing world
SCEC AN NSF+USGS CENTER
CGS CALIFORNIA GEOLOGICAL SURVEY
CEA CALIFORNIA EARTHQUAKE AUTHORITY THE STRENGTH TO REBUILD

UCERF3: A New Earthquake Forecast for California's Complex Fault System

With innovations, fresh data, and lessons learned from recent earthquakes, scientists have developed a new earthquake forecast model for California, a region under constant threat from potentially damaging events. The new model, referred to as the third Uniform California Earthquake Rupture Forecast, or "UCERF3" (http://www.WGCEP.org/UCERF3), provides authoritative estimates of the magnitude, location, and likelihood of earthquake fault rupture throughout the state. Overall the results confirm previous findings, but with some significant changes because of model improvements. For example, compared to the previous forecast (UCERF2), the likelihood of moderate-sized earthquakes (magnitude 6.5 to 7.5) is lower, whereas that of larger events is higher. This is because of the inclusion of multifault ruptures, where earthquakes are no longer confined to separate, individual faults, but can occasionally rupture multiple faults simultaneously. The public-safety implications of this and other model improvements depend on several factors, including site location and type of structure (for example, family dwelling compared to a long-span bridge). Building codes, earthquake insurance products, emergency plans, and other risk-mitigation efforts will be updated accordingly. This model also serves as a reminder that damaging earthquakes are inevitable for California. Fortunately, there are many simple steps residents can take to protect lives and property.

What is UCERF3?

California is sandwiched between the Pacific and North American tectonic plates, with the former migrating northwest about two inches per year compared to the latter. The plate boundary is far from smooth, reflecting more of a fragmented zone locked in a tectonic battle over which areas will give way, producing some of the steepest mountain ranges in the world. The sliding between plates is also not steady, but rather plays out in fits and starts with periods of rest interrupted by sudden slip along cracks in the Earth. These "fault ruptures" in turn cause the ground to shake, much like the ripples that radiate from a pebble tossed in a pond, and it is this shaking that causes the most damage in earthquakes.

Two kinds of scientific models are used to help safeguard against earthquake losses: an Earthquake Rupture Forecast, which tells us where and when the Earth might slip along the state's many faults, and a Ground Motion Prediction model, which estimates the subsequent shaking given one of the fault ruptures. UCERF3 is the first type of model, representing the latest earthquake-rupture forecast for California. It was developed and reviewed by dozens of leading scientific experts from the fields of seismology, geology, geodesy, paleoseismology, earthquake physics, and earthquake engineering. As such, it represents the best available science with respect to authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes throughout the state (further background on these models, especially with respect to ingredients, can be found in U.S. Geological Survey Fact Sheet 2008–3027, http://pubs.usgs.gov/fs/2008/3027/).

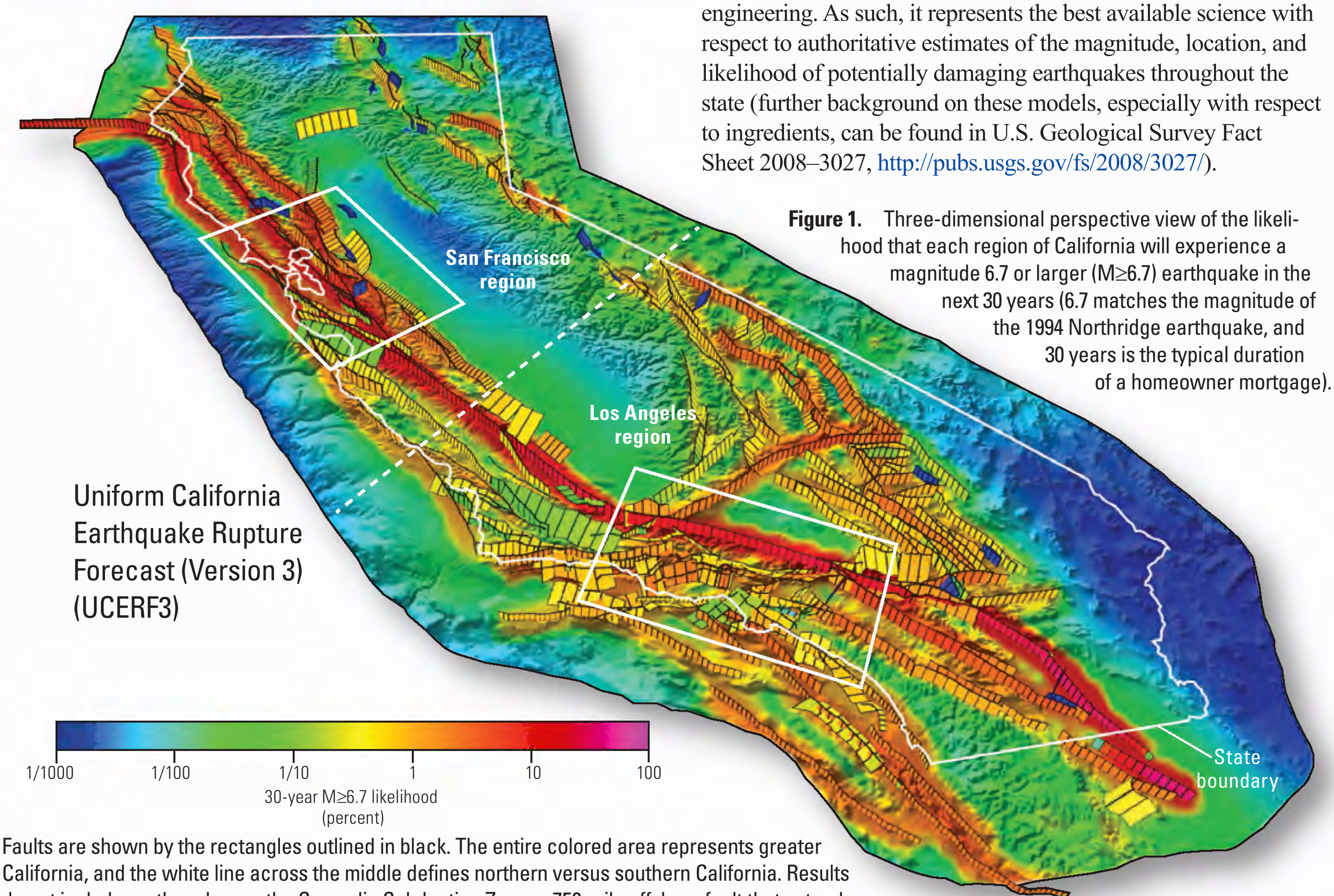


Figure 1. Three-dimensional perspective view of the likelihood that each region of California will experience a magnitude 6.7 or larger (M≥6.7) earthquake in the next 30 years (6.7 matches the magnitude of the 1994 Northridge earthquake, and 30 years is the typical duration of a homeowner mortgage).

Faults are shown by the rectangles outlined in black. The entire colored area represents greater California, and the white line across the middle defines northern versus southern California. Results do not include earthquakes on the Cascadia Subduction Zone, a 750-mile offshore fault that extends about 150 miles into California from Oregon and Washington to the north.

U.S. Department of the Interior
U.S. Geological Survey
Printed on recycled paper
ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20153009
Fact Sheet 2015–3009
March 2015

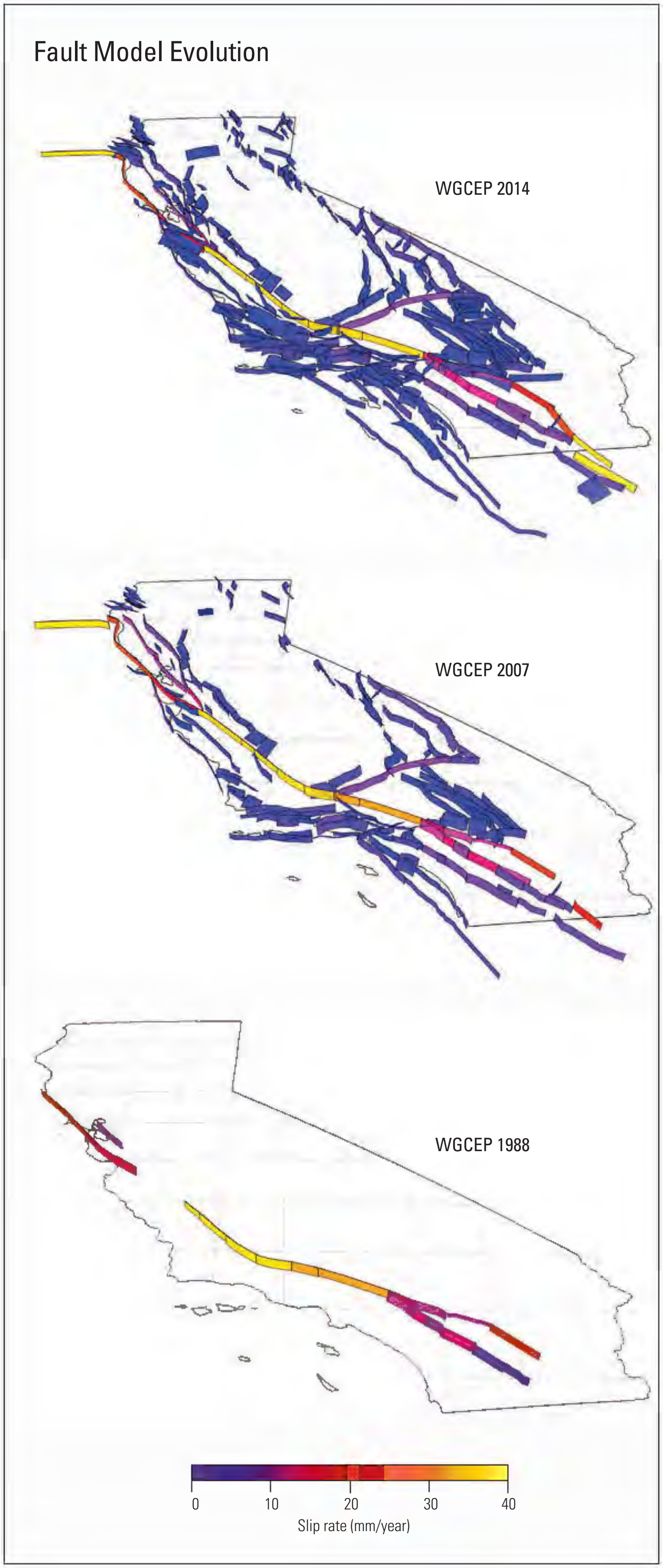


Figure 2. Changes with time of the inventory of faults used in California earthquake forecast models (WGCEP, Working Group on California Earthquake Probabilities).

Why a New Earthquake Forecast Model?

All scientific models, including earthquake rupture forecasts, are an approximation of the physical system they represent, in the same way that "the map is not the actual territory" (Korzbski, 1931). UCERF3 represents the latest model from the Working Group on California Earthquake Probabilities (WGCEP) (WGCEP, 2014), which also released forecasts in 1988, 1990, 1995, 2003, and 2007. This historical progression of models reflects increasingly accurate, detailed, and sophisticated representations of a particularly complex natural system.

A puzzling feature of previous models has been a forecasted rate of moderate-sized earthquakes (between magnitude 6.5 and 7.0) that is up to a factor of two higher than that observed historically. The first discovery of this discrepancy, by the 1995 WGCEP, was particularly disturbing in that one such event, the magnitude 6.7 1994 Northridge earthquake, had just surprised many as the costliest earthquake in U.S. history. In fact, the prospect of such events becoming more frequent contributed to an ensuing homeowner-insurance-availability crisis, as most insurance providers opted to pull out of the market altogether, rather than comply with a state law requiring they offer an earthquake option with each policy. This insurance availability crisis was ultimately solved in 1996 with the legislative creation of the California Earthquake Authority (http://www.earthquakeauthority.com), which has since become the largest earthquake insurance provider in the state. However, the discrepancy between the forecast rate and the observed rate at moderate magnitudes has remained through the most recent previous study (WGCEP, 2007), and scientists have hotly debated whether this is real or a result of some model limitation.

Recent earthquakes have fortunately provided clues. For example, the Northridge earthquake occurred on a previously unrecognized fault, which motivated scientists to search for other faults and quantify those that might be capable of producing damaging earthquakes. The effort has paid off. Whereas the 1988 WGCEP considered only 16 different faults, albeit the main ones, by the time of the WGCEP 2007 effort there were about 200. With UCERF3, there are now more than 350 fault sections in the model, thanks in part to using space-based geodesy where geologic data are limited. This historical progression is shown in the fault model evolution figure at left.

Another clue with respect to the moderate-magnitude rate discrepancy is that many recent earthquakes have plowed past previously inferred fault-rupture boundaries. That is, past models have generally assumed that earthquakes are either confined to separate faults, or that long faults like the San Andreas can be divided into different segments that only rupture separately. However, all three of the most-recent, largest earthquakes in California ruptured right past such boundaries, jumping from one fault to another as multifault ruptures. These were the 1992 magnitude 7.3 Landers, the 1999 magnitude 7.2 Hector Mine, and the 2010 magnitude 7.2 El Mayor–Cucapah earthquakes. The 2011 magnitude 9.0 Tohoku, Japan earthquake also violated previously defined fault-segment boundaries, resulting in a much larger fault-rupture area and magnitude than expected, and contributing to the deadly tsunami and Fukushima nuclear disaster.

Given these observations, the possibility of multifault ruptures clearly needed to be considered in our new model. In fact, as the inventory of California faults has grown over the years, it

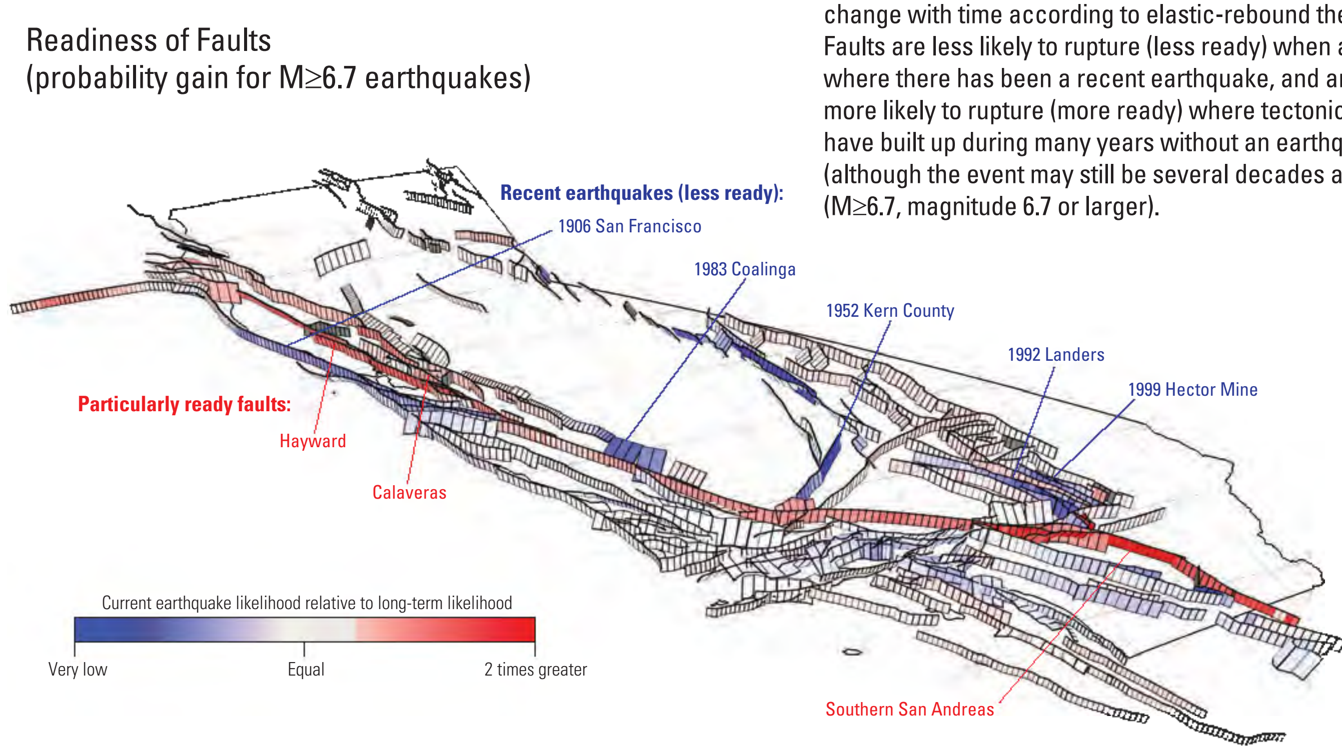


Figure 3. California earthquake likelihood in UCERF3 incorporates the concept that earthquake probabilities change with time according to elastic-rebound theory. Faults are less likely to rupture (less ready) when and where there has been a recent earthquake, and are more likely to rupture (more ready) where tectonic forces have built up during many years without an earthquake (although the event may still be several decades away) (M≥6.7, magnitude 6.7 or larger).

has become increasingly apparent that we are not dealing with a few well-separate faults, but with a vast interconnected fault system. In fact, it has become difficult to identify where some faults end and others begin, implying many more opportunities for multifault ruptures. As a consequence, UCERF3 now considers more than 250,000 different fault-based earthquakes, including multifault ruptures, whereas UCERF2 had about 10,000, and previous models had far fewer. Because we still lack a complete inventory of faults, UCERF3 (and UCERF2 before it) also includes the possibility of earthquakes on unrecognized faults elsewhere in the region.

Solving for the rate of all possible ruptures in the interconnected fault system represented a significant challenge. The UCERF3 methodological breakthrough, referred to as the "grand inversion," allowed us to not only solve for the rate of each earthquake rupture, but to also draw upon a broader range of observations in doing so. For example, the previous rate discrepancy at moderate-magnitudes was turned into part of the solution. That is, because the total plate-tectonic deformation is generally well known, any increase in the rate of larger, multifault ruptures must come with a consequent reduction in rates at lower magnitudes. The grand inversion manages the overall plate-tectonic, fault-system budget mathematically, adding whatever multifault ruptures are needed to eliminate the rate discrepancy at moderate magnitudes. So, not only does UCERF3 include the types of multifault ruptures seen in nature, but doing so has also eliminated the overprediction of moderate-sized events, implying the latter was simply a manifestation of the isolation and segmentation of faults in the previous models.

UCERF3 also includes the notion of fault "readiness," where earthquake likelihoods go down on faults that have recently ruptured, and build back up with time as tectonic stresses reaccumulate. Although this concept, known formally as Reid's elastic rebound theory (Reid, 1911), has been around for more than a century, applying it in a model that includes multifault ruptures also proved challenging. A new methodology was therefore developed, which also relaxes the requirement that the date-of-last event be known where applied. That is, we may not know when the most recent event occurred on many California faults, but we do know that it had to have been prior to 1875 (the year when reliable recordkeeping began). Being able to account for this "historic open interval" for events that precede 1875 allowed us to quantify fault readiness throughout the entire fault system (fig. 3), rather than being limited to only a subset of faults as in previous studies.

There are many uncertainties in both the data and scientific theories that go into UCERF3, and alternative values for each element can lead to a different forecast. Consequently, UCERF3 is not a single model, but rather a collection of 5,760 different viable models. The results presented in the next section represent an average of these forecasts. Calculating grand-inversion results for all the models required the use of super computers, as they would have taken more than 8 years on a single desktop computer.

What Are the Results, and How Do They Differ from Previous Estimates?

UCERF3 results for various regions and faults of interest are shown in the figures and tables here. How have expected earthquake rates changed from the previous model? Overall, the results confirm earlier findings (California is earthquake country), but with some important refinements in certain areas. Considering the entire region, the average time between magnitude 6.7 and larger earthquakes has gone from 1 every 4.8 years in UCERF2, to 1 about every 6.3 years in UCERF3, representing a 30 percent decrease in the new forecasted

Table 1. Average time between earthquakes in the various regions together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014). Values listed in parentheses indicate the factor by which the rates and likelihoods have increased, or decreased, since the previous model (UCERF2). "Readiness" indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes (see text). These values include aftershocks. It is important to note that actual repeat times will exhibit a high degree of variability, and will almost never exactly equal the average listed here.

Greater California region

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	0.12 (0.7)	100% (1.0)	1.0
6	1.2 (0.9)	100% (1.0)	1.0
6.7	6.3 (1.3)	>99% (1.0)	1.0
7	13 (1.3)	93% (1.0)	1.0
7.5	52 (1.0)	48% (1.0)	1.1
8	494 (0.8)	7% (1.5)	1.2

Southern California region

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	0.24 (0.7)	100% (1.0)	1.0
6	2.3 (0.9)	100% (1.0)	1.0
6.7	12 (1.5)	93% (1.0)	1.0
7	25 (1.4)	75% (0.9)	1.1
7.5	87 (1.2)	36% (0.9)	1.2
8	522 (0.4)	7% (2.5)	1.3

Northern California region

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	0.24 (0.7)	100% (1.0)	1.0
6	2.4 (0.9)	100% (1.0)	1.0
6.7	12 (1.2)	95% (1.0)	1.0
7	25 (1.2)	76% (1.0)	1.1
7.5	92 (0.9)	28% (1.1)	1.0
8	645 (0.8)	5% (1.4)	1.1

San Francisco region

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	1.3 (0.7)	100% (1.0)	1.0
6	8.9 (1.0)	98% (1.0)	1.0
6.7	29 (1.1)	72% (1.1)	1.1
7	48 (0.9)	51% (1.3)	1.1
7.5	124 (0.7)	20% (1.6)	0.9
8	825 (0.7)	4% (1.9)	1.0

Los Angeles region

Magnitude (greater than or equal to)	Average repeat time (years)	30-year likelihood of one or more events	Readiness
5	1.4 (0.6)	100% (1.0)	1.0
6	10 (1.1)	96% (1.0)	1.0
6.7	40 (2.1)	60% (0.8)	1.1
7	61 (2.0)	46% (0.7)	1.2
7.5	109 (1.3)	31% (0.9)	1.3
8	532 (0.4)	7% (2.5)	1.3

rate (and note that most of these events occur in remote areas of the state). For magnitude 8 and larger, on the other hand, the rate has increased by 20 percent in UCERF3, with an expected repeat time of 494 years for UCERF3, down from 1 every 617 years in UCERF2. These changes are a direct and expected manifestation of including multifault ruptures in UCERF3. A more careful analysis of historical seismicity has also produced an increased rate for magnitude 5 and greater earthquakes, going from about 5.8 per year in UCERF2 to 8.3 per year in UCERF3. All of these trends are similar to those seen in various subregions of the state, with differences being slightly more dramatic for the Los Angeles area because that region has a large number of faults that can now host multifault ruptures.

Results are also expressed in terms of the likelihood of experiencing one or more earthquakes in the next 30 years, the duration of a typical home mortgage, and these values also take fault readiness into consideration (how long it has been since the most recent event). As in UCERF2, the likelihood for magnitude 6.7 and larger earthquakes somewhere in the entire region remains near certainty (greater than 99 percent). The likelihood is 7 percent for magnitude 8 and greater, a 50 percent increase over UCERF2, resulting from both the inclusion of multifault ruptures and the particular readiness of some large faults.

One particularly ready fault is the Southern San Andreas, which contributes to its continued status of being the most likely to host a large earthquake. Specifically, it has a 19 percent chance of having one or more events larger than magnitude 6.7 in the next 30 years near Mojave, Calif. The comparably low values for the Northern San Andreas, such as 6.4 percent near San Francisco, are partly because of the relatively recent 1906 earthquake on that fault. In fact, probabilities on two other Bay Area faults, the Hayward–Rodgers Creek and the Calaveras, currently rival or exceed those on the Northern San Andreas, in part because they are both relatively ready.

Compared to the previous model, UCERF2, the San Jacinto fault has a three-fold decrease in the likelihood of magnitude 6.7 or larger earthquakes. Much of this decrease is because of the inclusion of more multifault ruptures, as indicated by the factor of 57 increase in the likelihood of magnitude 8 and larger earthquakes. In other words, the fault has traded some moderate-sized events for rare larger ones.

The Calveras fault, on the other hand, has a three-fold increase in the likelihood of magnitude 6.7 or larger earthquakes. In UCERF2 most Calaveras events were well below magnitude 6.7, so the inclusion of multifault ruptures in UCERF3 has increased the frequency of earthquakes above magnitude 6.7.

We have only touched on a few of the more important changes between UCERF2 and UCERF3, and have highlighted only some of the influential factors. Many more are currently understood, and scientists will be further analyzing results and testing assumptions for years to come.

So what do these changes imply with respect to seismic hazard, the likelihood of ground shaking, as well as for seismic risk, the threat to the built environment with respect to fatalities and economic losses? The answer turns out to be entirely dependent on what you are concerned about. For example, increasing the likelihood of large multifault earthquakes, which consequently reduces the likelihood of moderate-sized events, may increase the risk to tall buildings or large bridges, but actually lower the risk to residential homes.

As a consequence, it is difficult to make generalizations about the hazard or risk implications of UCERF3 without first specifying both asset types and their locations. Conclusions will vary depending on whether you are designing a single family dwelling in Sacramento, retrofitting the San Francisco–Oakland Bay Bridge, considering the location of a nuclear power plant, laying pipeline across the San Andreas Fault, or considering aggregate losses over a large insurance portfolio. The practical implications will need to be considered on a case-by-case basis.

What Next?

UCERF3 can now be used to evaluate seismic hazard and risk in California. In fact, it has already been used for the 2014 update of the U.S. Geological Survey National Seismic Hazard Maps (http://earthquake.usgs.gov/hazards/), which in turn are used in building codes. The California Earthquake Authority, which is required by law to use the best available science, will use UCERF3 to evaluate insurance premiums charged to customers, as well as their own level of reinsurance. UCERF3 will be used in many other risk mitigation

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

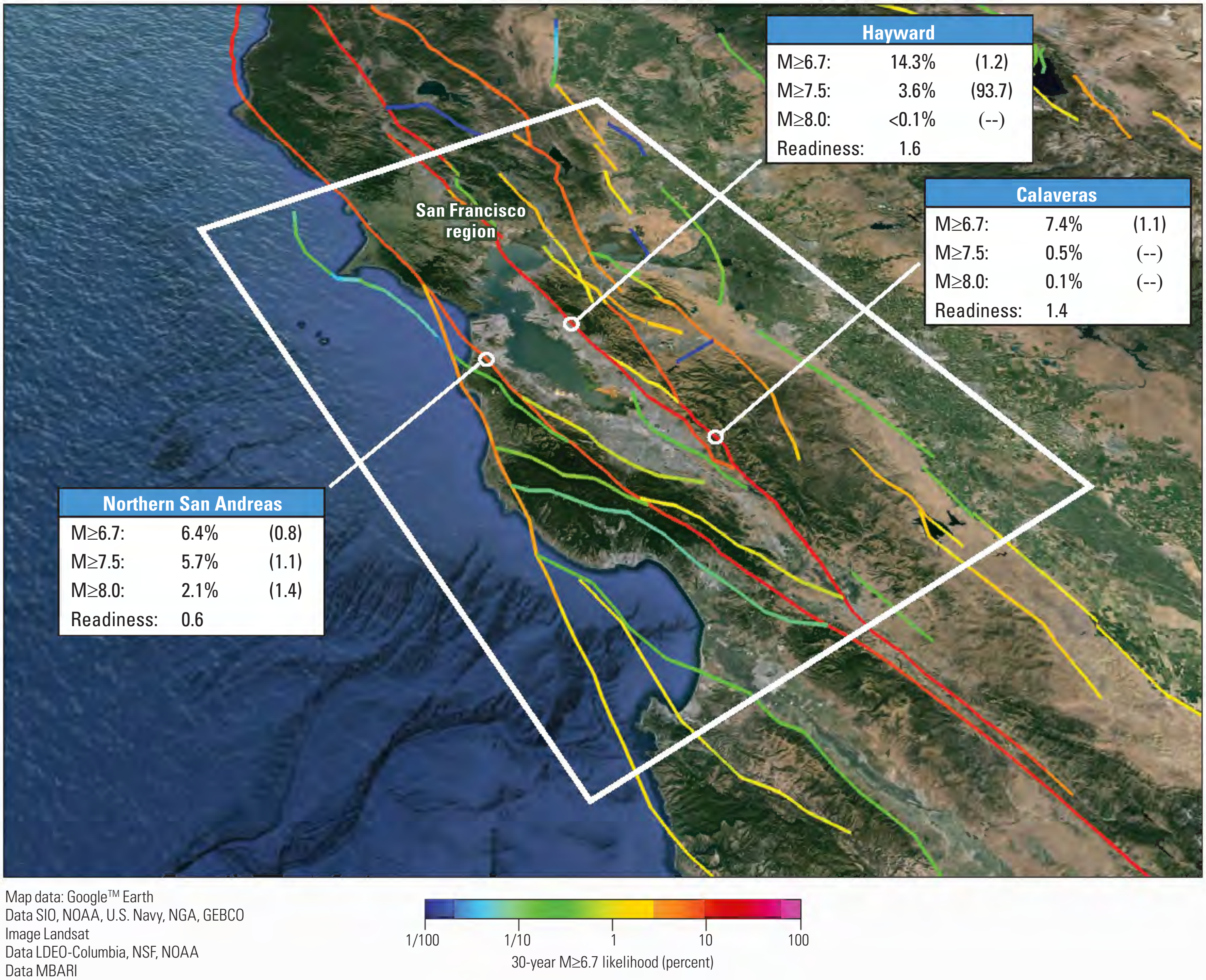


Figure 4. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near San Francisco, Calif.

efforts in the years to come, including engineering design of buildings and lifelines, loss estimation for catastrophic bonds and other risk-linked securities, and emergency preparedness, all of which have the ultimate goal of increasing public safety and community resilience.

UCERF3 should also serve as a reminder that California is earthquake country, and residents should always be prepared. Simple safeguards include practicing "drop, cover, and hold on," securing items in your home and workplace that could fall during an earthquake, and storing seven-days worth of food and water. Homeowners can also consider structural retrofits, such as bolting the house to its foundation, as well as earthquake insurance options. For further guidance on how to prepare for, survive, and recover after big earthquakes, follow the Seven Steps to Earthquake Safety (http://www.earthquakecountry.org/sevensteps).

Although UCERF3 is a clear improvement over the previous model (UCERF2), it is still an approximation of the natural system. For example, it does not model the earthquake-triggering process that produces aftershocks, even though we know such events can be large and damaging. Through the National Earthquake Hazard Reduction Program (http://www.nehrp.gov), the U.S. Geological Survey and its partners will continue to conduct research aimed at improving our understanding of fault behavior and estimates of earthquake hazard in the future.

Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014).

[At the points on the fault indicated by white circles. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other two magnitude thresholds. %, percent. Values listed in parentheses indicate the factor by which the likelihoods have increased, or decreased, relative to the previous model (UCERF2), where "--" means the previous value was zero. "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake]

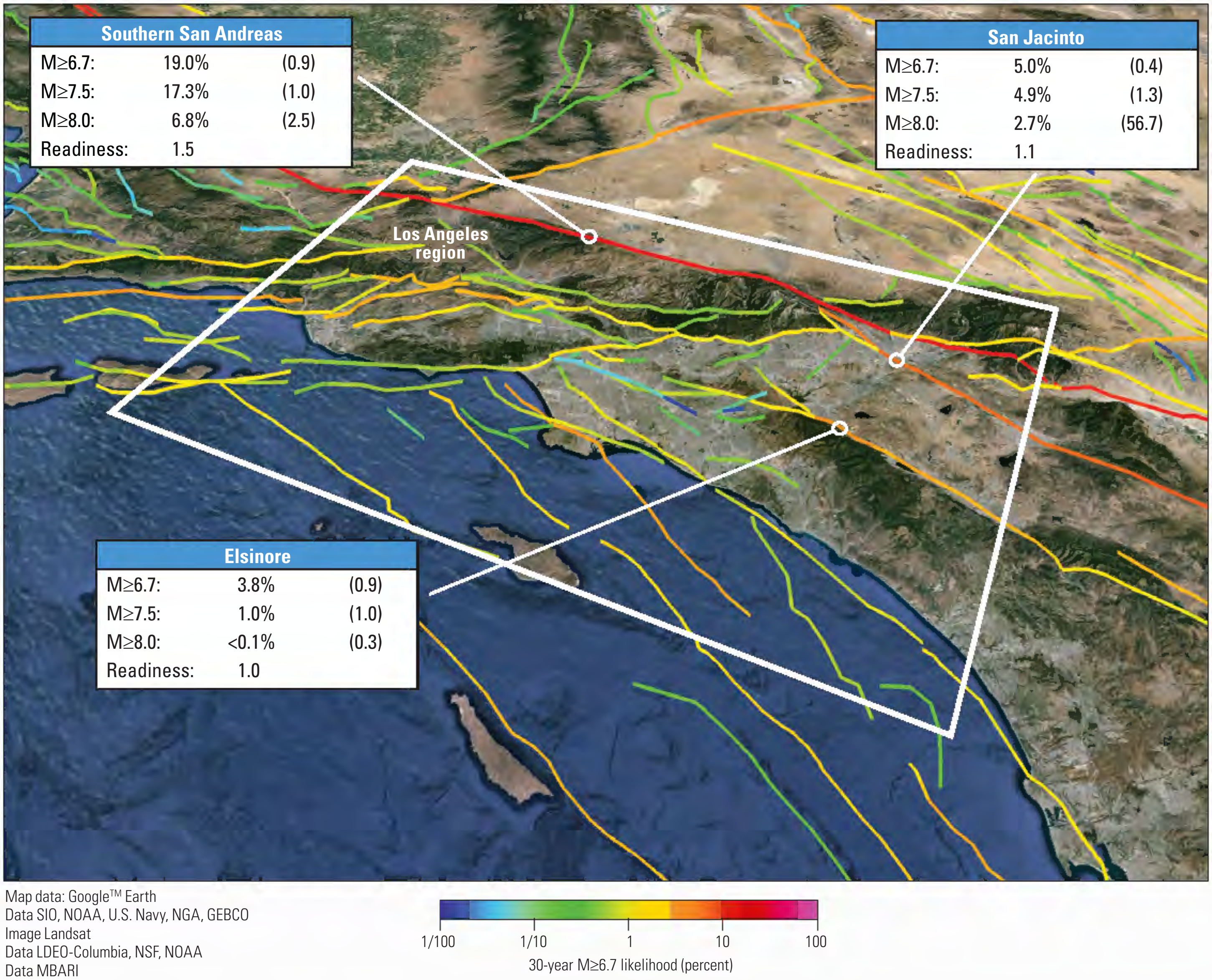


Figure 5. Likelihood of magnitude 6.7 or greater earthquakes in the next 30 years, from 2014, on the faults near Los Angeles, Calif.

References

Korzybski, A. 1931, A non-Aristotelian System and its necessity for rigour in mathematics and physics: presention at the American Mathematical Society, December 28, 1931, New Orleans, Louisiana, meeting of the American Association for the Advancement of Science. Reprinted in Science and Sanity, 1933, p. 747–61.

Reid, H.F., 1911, The elastic-rebound theory of earthquakes: University of California Publications, Bulletin of the Department of Geological Sciences v. 6, p. 413–444.

Working Group on California Earthquake Probabilities, 2007, Published as: Field, E.H., Dawson, T.E., Felzer, K.R., Frankel, A.D., Gupta, V., Jordan, T.H., Parsons, T., Petersen, M.D., Stein, R.S. Weldon, II, R.J., and Wills, C.J., 2009, Uniform California earthquake rupture forecast, Version 2 (UCERF 2): Bulletin of the Seismological Society of America, v. 99, p. 2053–2107, doi:10.1785/0120080049.

Working Group on California Earthquake Probabilities, in press, Published as: Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R. Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C. Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J. II, , and Zeng, Y., 2015, Long-term, time-dependent probabilities for the third uniform California earthquake rupture forecast (UCERF3), Bulletin of the Seismological Society of America.

—Authors: Edward H. Field and members of the 2014 WGCEP

Cooperating organizations:
Southern California Earthquake Center (SCEC)
California Geological Survey (CGS)
California Earthquake Authority
U.S. Geological Survey

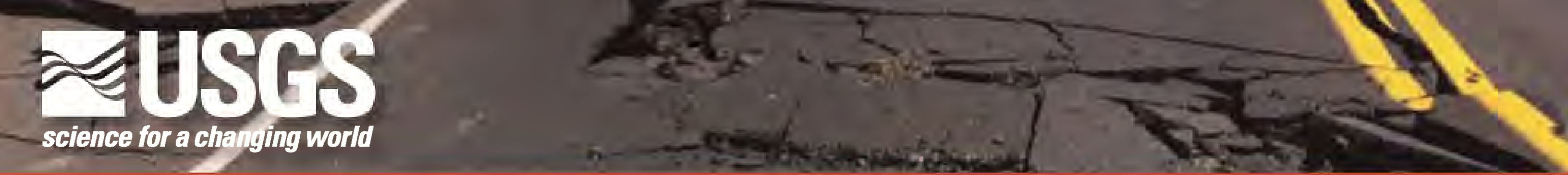
Additional Resources:

For general earthquake information contact:
1-888-ASK-USGS (1-888-275-8747)
http://earthquake.usgs.gov/
http://ask.usgs.gov
or
SCEC Education and Outreach: 213-740-3262

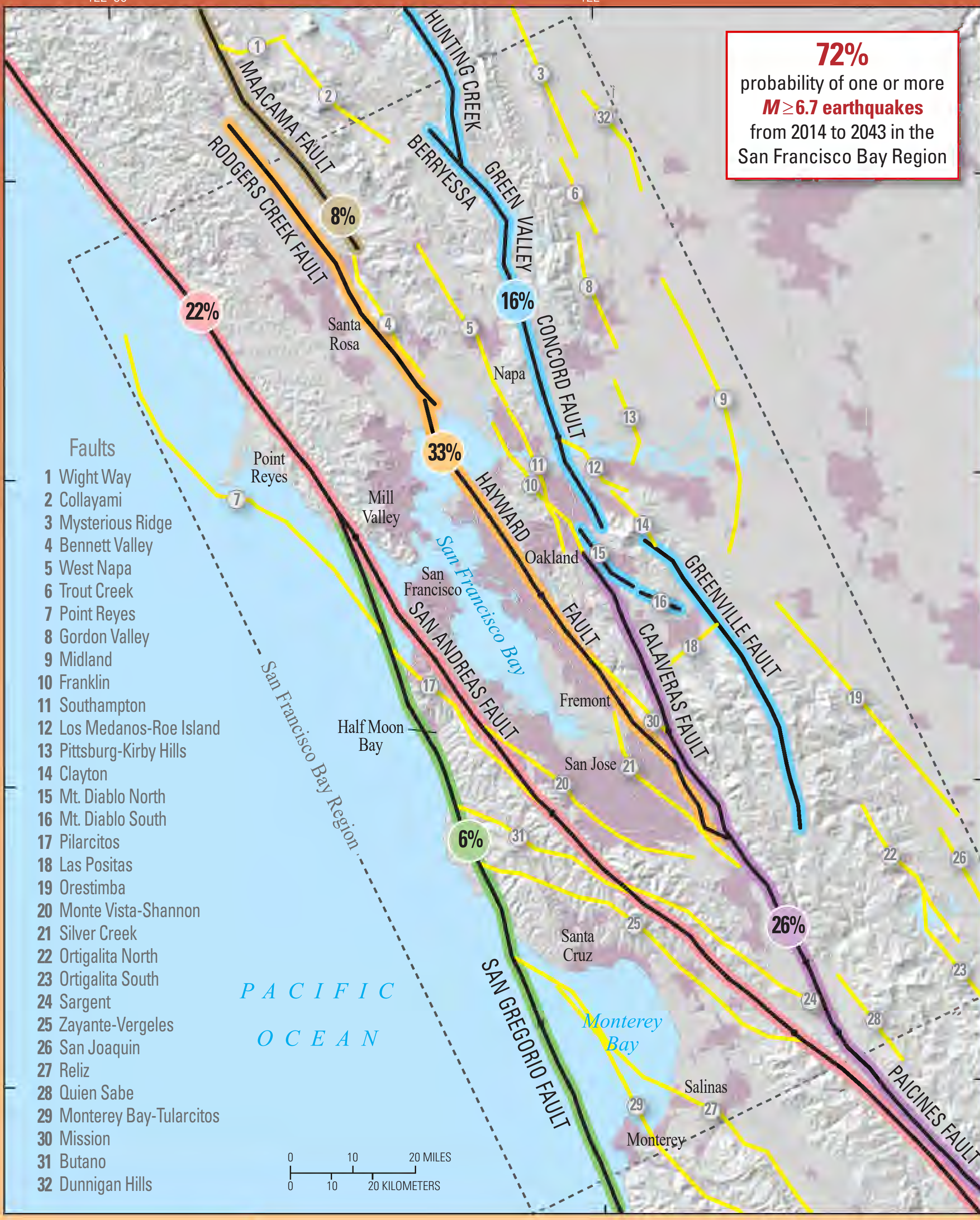
For UCERF3 information see:
http://www.WGCEP.org/UCERF3

For technical questions contact:
Edward (Ned) Field: field@usgs.gov

Appendix G



Earthquake Outlook for the San Francisco Bay Region 2014–2043



EXPLANATION

- Major plate boundary faults
- Lesser-known smaller faults
- Urban areas

Map of known active faults in the San Francisco Bay region. The 72 percent probability of a magnitude 6.7 or greater earthquake includes the well-known major plate-boundary faults, lesser-known faults, and unknown faults. The percentage shown within each colored circle is the probability that a magnitude 6.7 or greater earthquake will occur somewhere on that fault system by the year 2043. The probability that a magnitude 6.7 or greater earthquake will involve one of the lesser-known faults is 13 percent.

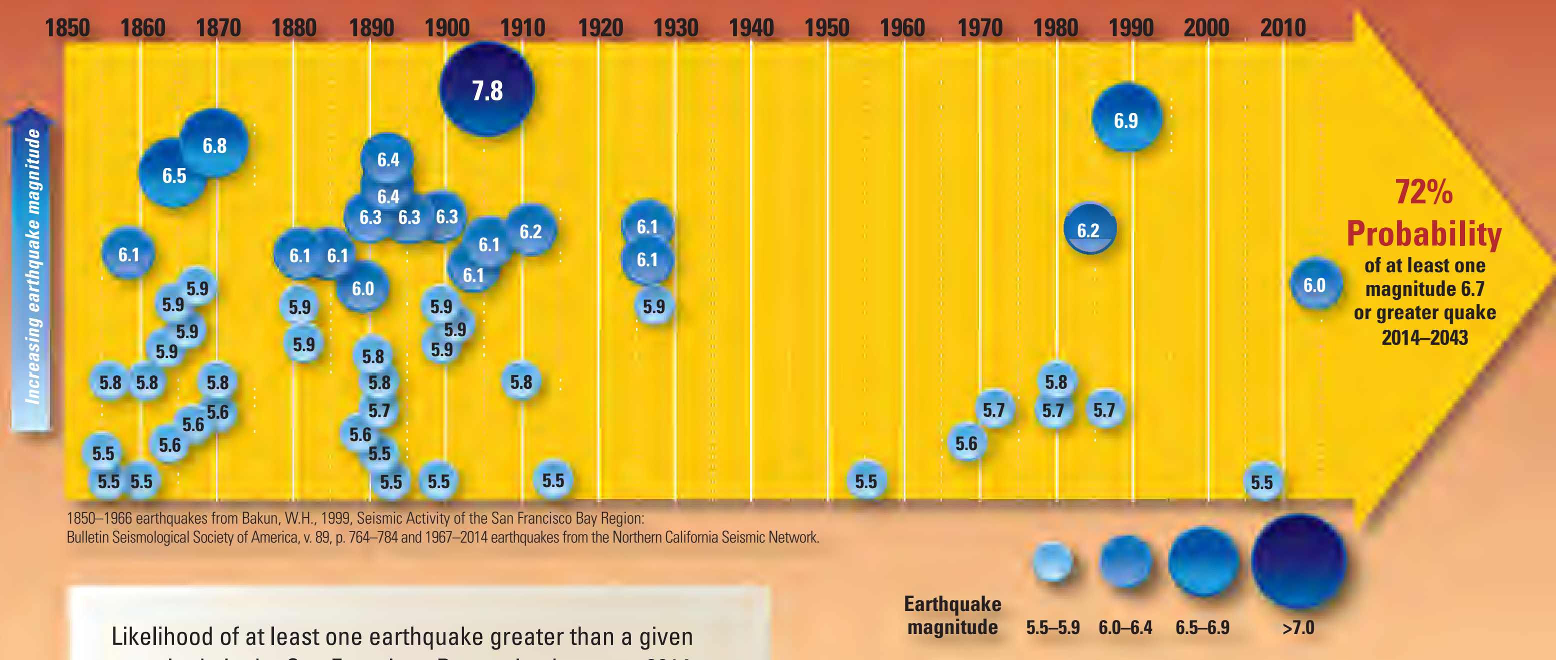
Using information from recent earthquakes, improved mapping of active faults, and a new model for estimating earthquake probabilities, the 2014 Working Group on California Earthquake Probabilities updated the 30-year earthquake forecast for California. They concluded that there is a 72 percent probability (or likelihood) of at least one earthquake of magnitude 6.7 or greater striking somewhere in the San Francisco Bay region before 2043. Earthquakes this large are capable of causing widespread damage; therefore, communities in the region should take simple steps to help reduce injuries, damage, and disruption, as well as accelerate recovery from these earthquakes.

Building damaged in 2014 South Napa earthquake. Photograph by Erol Kalkan, U.S. Geological Survey.

U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2016–3020
Revised August 2016 (ver. 1.1)

San Francisco Bay Region Earthquake Timeline



1850–1966 earthquakes from Bakun, W.H., 1999, Seismic Activity of the San Francisco Bay Region: Bulletin Seismological Society of America, v. 89, p. 764–784 and 1967–2014 earthquakes from the Northern California Seismic Network.

Likelihood of at least one earthquake greater than a given magnitude in the San Francisco Bay region between 2014 and 2043.

Magnitude (*M*)	30-year likelihood of at least one earthquake in the San Francisco Bay region
$M \geq 6.0$	98 percent
$M \geq 6.7$	72 percent
$M \geq 7.0$	51 percent
$M \geq 7.5$	20 percent

Timeline of magnitude 5.5 and greater earthquakes in the San Francisco Bay region 1850–2014. In the 50 years prior to 1906, there were 13 earthquakes with a magnitude between 6 and 7, but only 6 earthquakes of similar magnitude in the 110 years since 1906. The rate of large earthquakes is expected to increase from this low level as tectonic plate movements continue to increase the stress on the faults in the region.

Earthquake Preparedness Helps

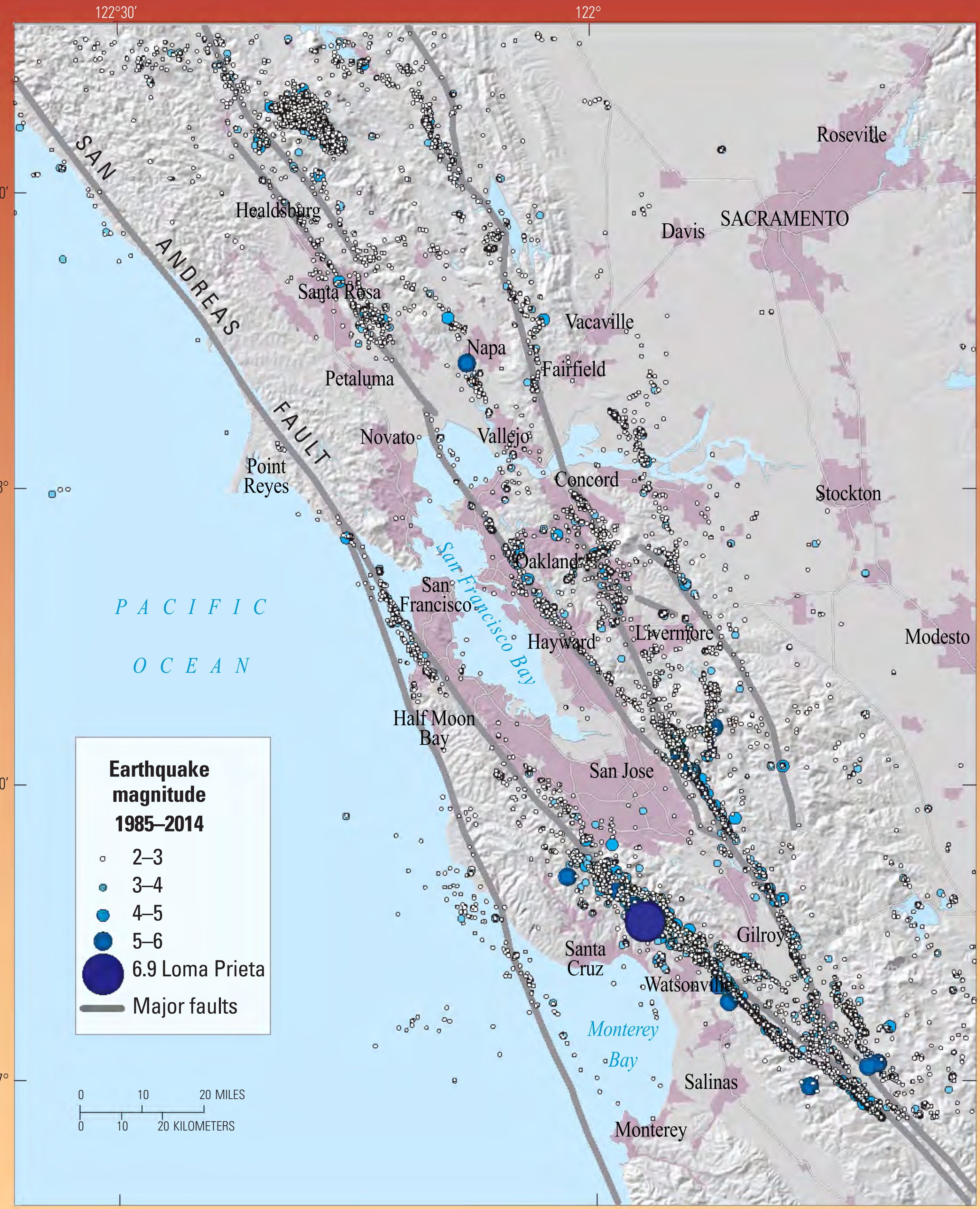
Early Sunday morning on August 24, 2014, the residents of Napa, California, were jolted awake by a strong, magnitude 6.0 earthquake. Within 30 minutes, the staff of Becoming Independent, a non-profit o ganization that helps adults with intellectual disabilities lead independent lives, called the people they serve in the affected area. The staff quickly visited all of the clients that needed help with cleanup and making their homes safe, a task made easier because both groups were trained in disaster preparedness and the clients had emergency kits with needed supplies on hand. The South Napa earthquake shifted houses off their foundations, damaged chimneys, started fires, and broke water mains throughou the city, causing hundreds of millions of dollars in economic losses. Many historic masonry buildings in downtown Napa were damaged. The earthquake was the largest in the San Francisco Bay region since the 1989 magnitude 6.9 Loma Prieta earthquake and a clear reminder of the seismic vulnerability of the region. The staff and clients of Becoming Independent showed that understanding and preparing for these events can improve how we live with future earthquakes.

Why Does the San Francisco Bay Region Have Earthquakes?

The same geologic process that is responsible for the San Francisco Bay region's beautiful coastlines, bays, hills, and valleys is also the primary driving force for earthquakes along faults in the region. The Bay region is located within the active boundary between the Pacific and the North American tectonic plates, where the Pacific plate slowl and continually slides northwest past the North American plate. The San Andreas Fault, on which two magnitude 7.8–7.9 earthquakes have occurred in historical time, including the 1906 San Francisco earthquake, is the fastest slipping fault along the plate boundary. Other major plate boundary faults in the San Francisco Bay region include the Hayward, Rodgers Creek, Calaveras, Maacama, San Gregorio, Concord, Green Valley, and Greenville Faults.

How Do Scientists Calculate Earthquake Probability?

Scientists rely upon a variety of techniques to help understand the rate and magnitude of past earthquakes in order to estimate the likelihood of future earthquakes. The Global Positioning System (GPS) and other land surveying and geologic techniques have allowed scientists to make more accurate measurements of how the current plate motions—totaling 1.6 inches per year across the San Francisco Bay region—distribute stress onto these individual faults. Balancing plate motions with the slip during large earthquakes and slow creep on faults allows scientists to calculate average rates of earthquake occurrence over periods of hundreds to thousands of years. (Continued on page 4)



Map of earthquakes greater than magnitude 2.0 in the San Francisco Bay region from 1985–2014. Small earthquakes occur on both major faults (shown by the gray lines) and minor faults (not shown). Because of the variability of fault geometry, earthquakes at depth do not always coincide with the mapped faults at the Earth's surface. There are sections of major faults, particularly the San Andreas Fault, with few or no small earthquakes but they will produce large earthquakes in the future. Compiled from the Northern California Seismic Network.

(Continued from page 2). A trench excavated across the Hayward Fault in Fremont revealed evidence of 12 large earthquakes over the past 1,900 years. The time interval between these earthquakes ranged from about 100 to 210 years. Historical records indicate that the most recent large earthquake on this fault occurred in 1868. However, detailed information about other past earthquakes in the San Francisco Bay region is difficult to obtain because seismograph records only go back to about 1900, historical accounts are sparse before 1850, and there are limited locations where faults can be trenched to identify and date prehistoric earthquakes.

Calculating accurate earthquake probabilities for short periods, such as 30 years, is also challenging. Although the 30-year time interval is convenient for humans, it is much less than the average time between large earthquakes on these faults, which can range from hundreds to thousands of years. The rate of large earthquakes in the San Francisco Bay region was high in the late 1800s but dropped abruptly after the 1906 San Francisco earthquake on the San Andreas Fault. Scientists believe that the post-1906 earthquake rate decreased because the large amount of slip along the San Andreas Fault in 1906 temporarily reduced the stress on many of the faults in the region. However, the ongoing motion of the tectonic plates began rebuilding stresses after the 1906 event, and earthquakes larger than magnitude 5.5 resumed during the second half of the 20th century. Future large, damaging earthquakes in the San Francisco Bay region, similar in size to the 1989 Loma Prieta and 1906 San Francisco earthquakes, may or may not be accompanied by the level of earthquake activity observed in the late 1800s.

The 2014 Uniform California Earthquake Rupture Forecast version 3 (http://pubs.usgs.gov/fs/2015/3009/) provides an updated estimate of the likelihood of large earthquakes in California over a 30-year time window from 2014 to 2043. The forecast accounts for how fast stress is accumulating on each fault due to plate motions and the time since its most recent large earthquake(s). In updating the probability calculations, scientists used a more complete set of faults for the San Francisco Bay region than those used in the previous (2008) calculations, adding 32 smaller faults to the 5 major fault systems. The new study has also incorporated more options for how multiple faults might rupture together in large earthquakes.

Probabilities of Earthquakes in the San Francisco Bay Region

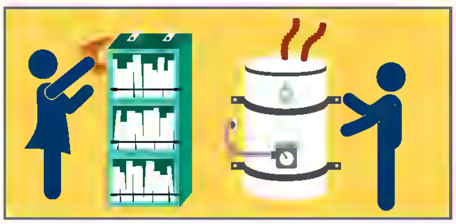
Smaller earthquakes occur more frequently than larger earthquakes. The probability that an earthquake of magnitude 6.0 or larger will occur before 2043 is 98 percent. The probability of at least one earthquake of magnitude 6.7 or larger in the San Francisco Bay region is 72 percent, and for at least one earthquake of magnitude 7.0 or larger it is 51 percent. These probabilities include earthquakes on the major faults, lesser-known faults, and unknown faults.

The probability of a large earthquake occurring on an individual fault in the San Francisco region is lower than the probability of an earthquake occurring anywhere in the region. The faults in the region with the highest estimated probability of generating damaging earthquakes between 2014 and 2043 are the Hayward, Rodgers Creek, Calaveras, and San Andreas Faults. In this 30-year period, the probability of an earthquake of magnitude 6.7 or larger occurring is 22 percent along the San Andreas Fault and 33 percent for the Hayward or Rodgers Creek Faults. Individual sections of these faults have lower probabilities for large earthquakes to occur (continued on page 6);

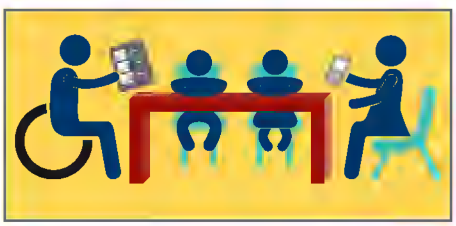
Seven Steps to Earthquake Safety

PREPARE

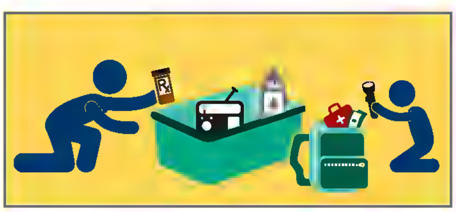
Before the next big earthquake we recommend these four steps that will make you, your family, or your workplace better prepared to survive and recover quickly:



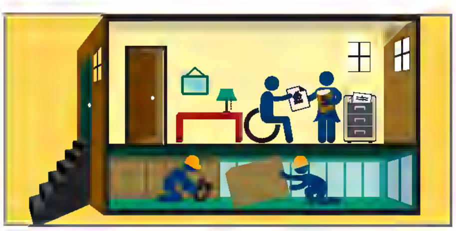
Step 1: Secure your space by identifying hazards and securing moveable items.



Step 2: Plan to be safe by creating a disaster plan and deciding how you will communicate in an emergency.



Step 3: Organize disaster supplies in convenient locations.



Step 4: Minimize financial hardship by organizing important documents, strengthening your property, and considering insurance.

SURVIVE

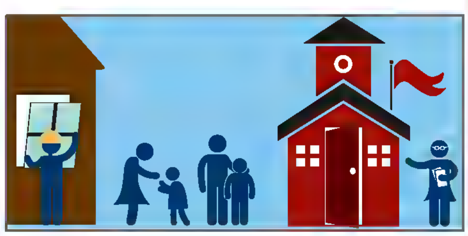
During the next big earthquake, and immediately after, is when your level of preparedness will make a difference in how you and others survive and can respond to emergencies:

Step 5: Drop, Cover, and Hold On when the earth shakes.

Step 6: Improve safety after earthquakes by evacuating if necessary, helping the injured, and preventing further injuries or damage.

RECOVER

After the immediate threat of the earthquake has passed, your level of preparedness will determine your quality of life in the weeks and months that follow:

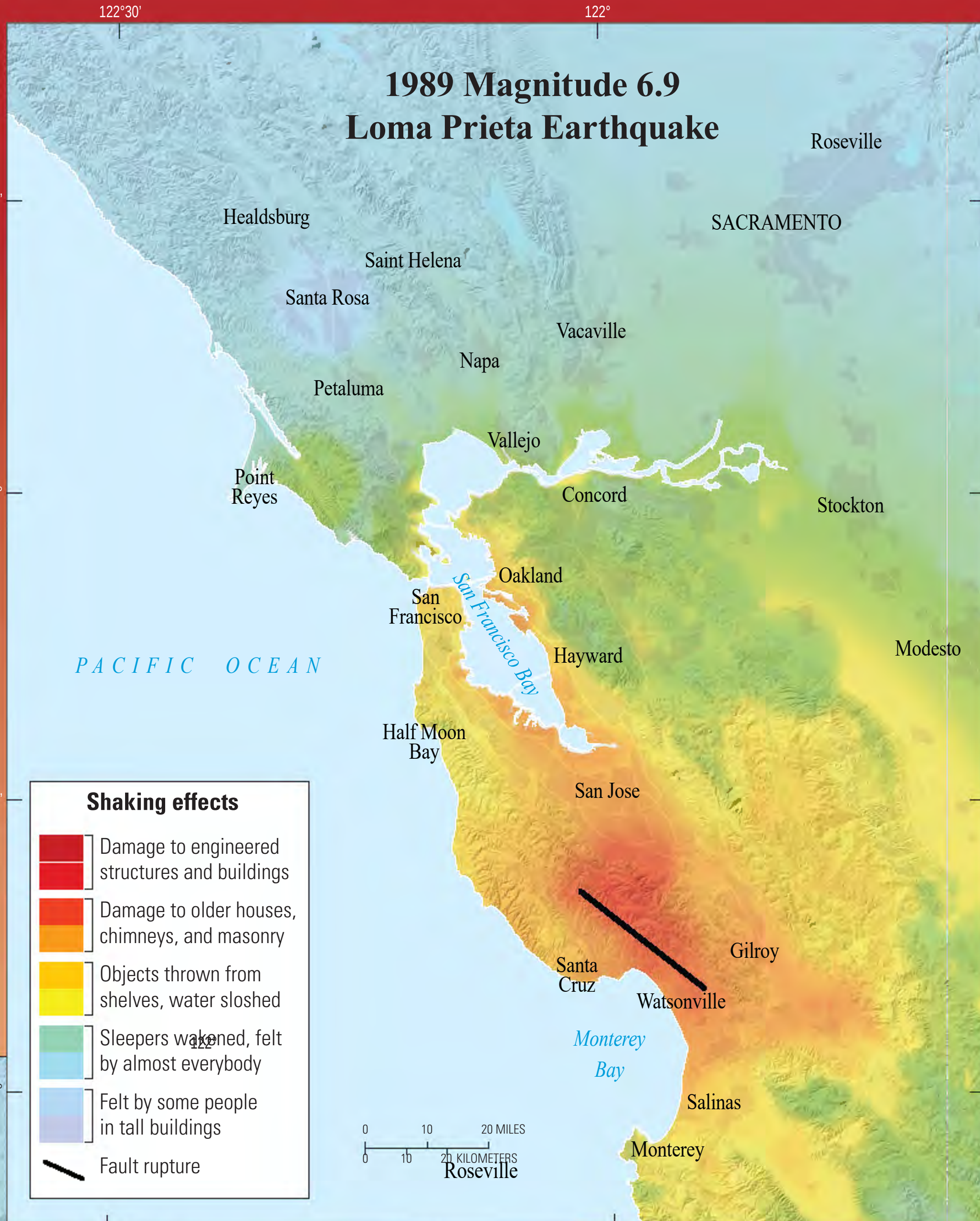


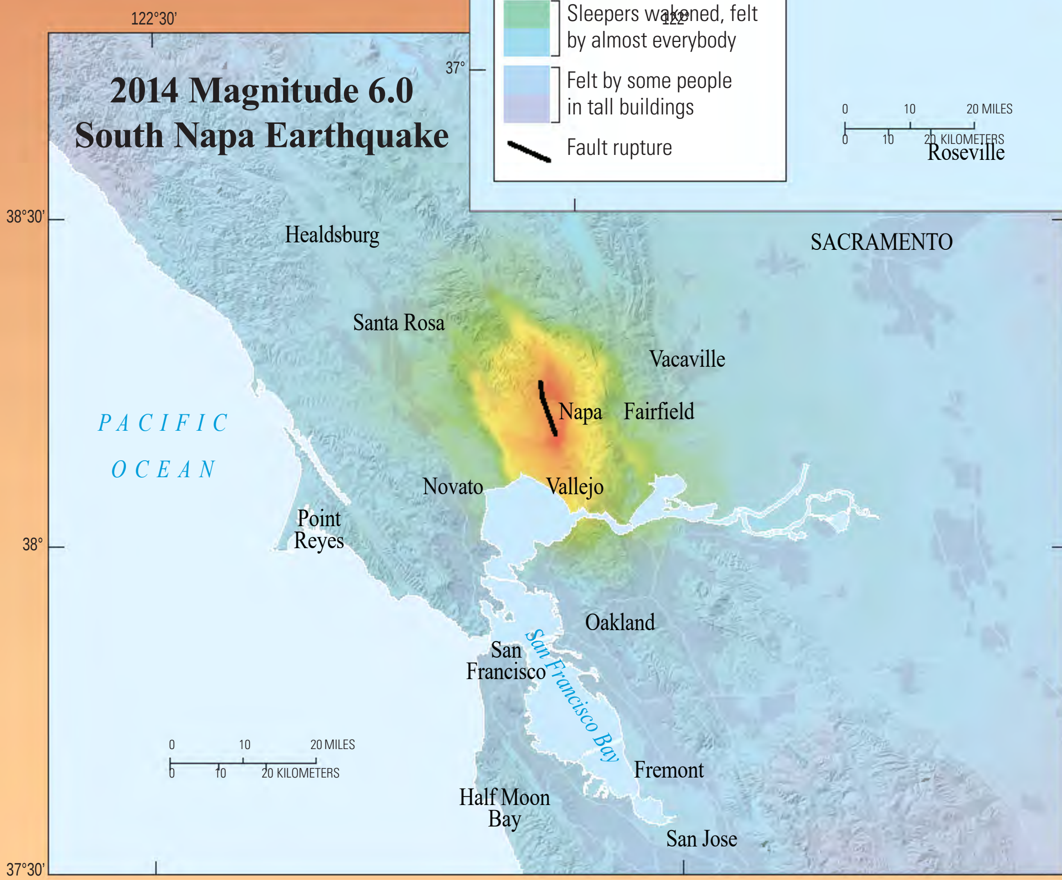
Step 7: Reconnect and Restore. Restore daily life by reconnecting with others, repairing damage, and rebuilding community.

Adapted from Seven Steps To Earthquake Safety
http://earthquakecountry.org/sevensteps/

Maps showing intensity of ground shaking for the South Napa and Loma Prieta earthquakes. The black lines show the location of fault slip at depth. The maps illustrate how the area subjected to strong shaking increases with increasing earthquake magnitude.

Road damage from the Loma Prieta earthquake. Photograph by H.G. Wilshire, U.S. Geological Survey.





Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

Additional Earthquake Resources

American Red Cross – Bay Area (http://www.redcross.org/local/northern-california-coastal)
Association of Bay Area Governments (http://resilience.abag.ca.gov/earthquakes/)
Bay Area Earthquake Alliance (http://bayquakealliance.org/)
California Earthquake Authority (http://www.californiarocks.com/)
California Geological Survey (http://www.consrv.ca.gov/cgs/geologic_hazards/earthquakes)
Did You Feel It? (http://earthquake.usgs.gov/earthquakes/dyfi)
Earthquake Country Alliance (http://earthquakecountry.org/)
Putting Down Roots in Earthquake Country (http://pubs.usgs.gov/gip/2005/15/)
ShakeAlert – An Earthquake Early Warning System for the United States West Coast (http://pubs.usgs.gov/fs/2014/3083/)
ShakeMap (http://www.cisn.org/shakemap/nc/shake/index.html)
ShakeOut.org (http://www.shakeout.org/california/bayarea/)
Uniform California Earthquake Rupture Fault version 3 Fact Sheet (http://pubs.usgs.gov/fs/2015/3009/)
United Policyholders (http://www.uphelp.org/)
USGS Real-Time Earthquakes (http://earthquake.usgs.gov/earthquakes/map/)

Damaged building in downtown Napa. Photograph by Erol Kalkan, U.S. Geological Survey.

(continued from page 5) however, an earthquake of magnitude 6.7 or larger will cause strong shaking over a broad area. Therefore, it is important to estimate the probability of a large earthquake occurring anywhere in the San Francisco Bay region.

What is the Likelihood That an Earthquake Will Affect You?

Earthquake probabilities are only one component in the evaluation of earthquake hazards. Higher magnitude earthquakes have broader areas of intense shaking and cause more damage than lower magnitude earthquakes. In a magnitude 6.0 earthquake, strong shaking and damage are confined to a localized area, as illustrate by the 2014 South Napa earthquake. In comparison, the 1989 magnitude 6.9 Loma Prieta earthquake caused damage over a region nearly 100 miles long. Local soil and geologic conditions, bedrock type, quality of building construction, and susceptibility to flooding (caused by da or levee failure) can also affect the amount of damage at a particular site. This was dramatically demonstrated by the 1989 Loma Prieta earthquake, which devastated vulnerable parts of Oakland and San Francisco, more than 50 miles from the fault rupture.

How Can You Protect Yourself and Your Family?

Taking simple steps before and during earthquakes can help protect you and your family, as well as speed your recovery from an earthquake.

Before the next earthquake:

- Assess your home and work space, identify hazards, and secure moveable items.
- Create an emergency plan and organize disaster supplies to sustain you and your family for 72 hours or longer.
- Practice “Drop, Cover, and Hold On” to protect yourself when the ground begins to shake. Learn and practice what to do at home, work, or in school.
- Stay prepared by repeating these steps on a regular basis. For example, reassess your preparedness every year and participate in the annual Great California ShakeOut drill on the third Thursday in October.

Lack of adequate shear walls on the garage level exacerbated damage to this building at the corner of Beach and Divisadero in the Marina District, San Francisco, during the October 1989 Loma Prieta earthquake.

Brad T. Aagaard, James Luke Blair, John Boatwright, Susan H. Garcia Ruth A. Harris, Andrew J. Michael, David P. Schwartz, and Jeanne S. DiLeo

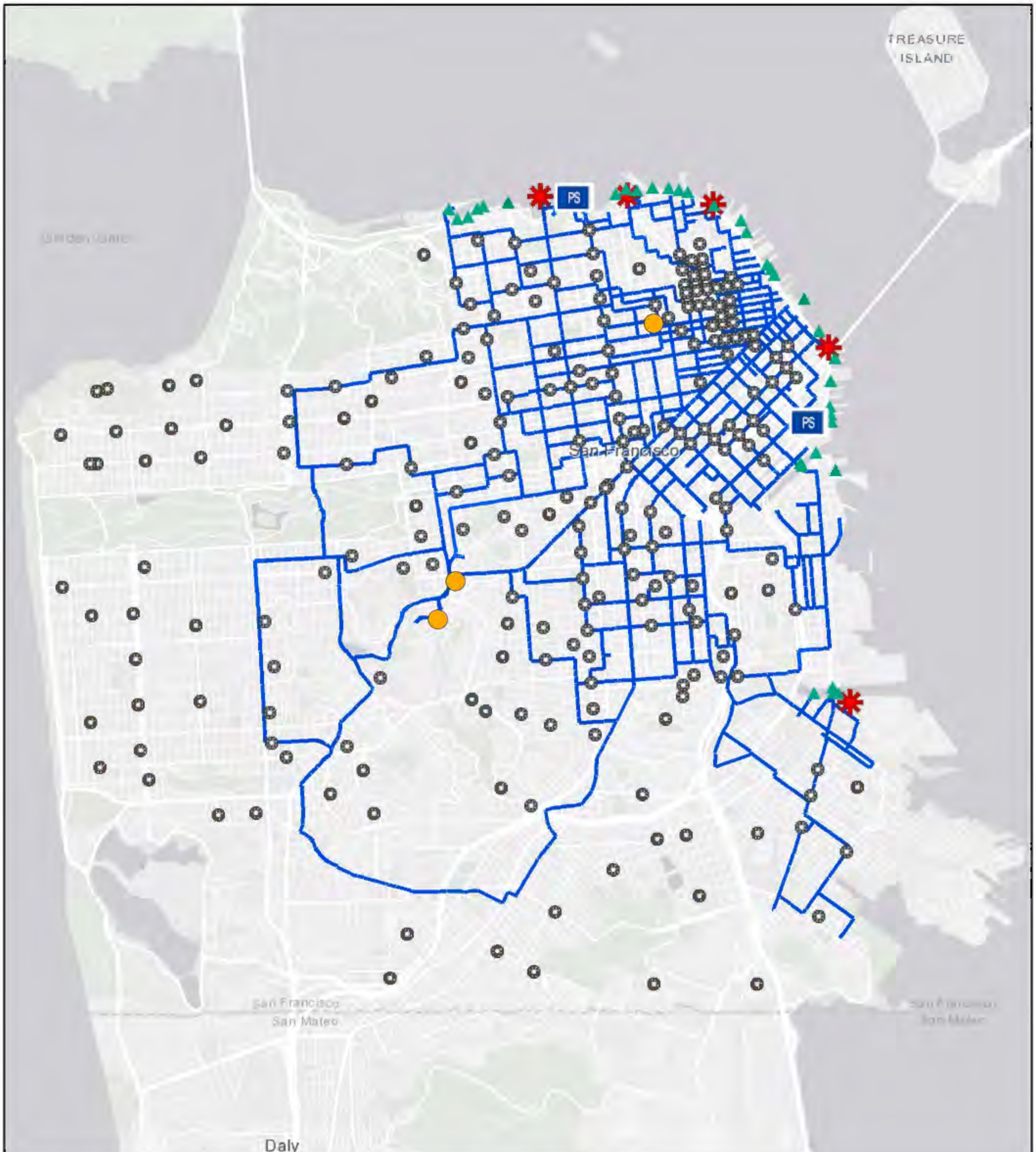
Edited by *Kate Jacques* and *Carolyn Donlin*

For more information contact:
1-888-ASK-USGS
(1-888-275-8747)

http://earthquake.usgs.gov/
http://ask.usgs.gov
https://www.facebook.com/USGeologicalSurvey
https://twitter.com/USGS

ISSN 2327-6916 (print) ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20163020

Appendix H



Existing EFWS - Assets

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

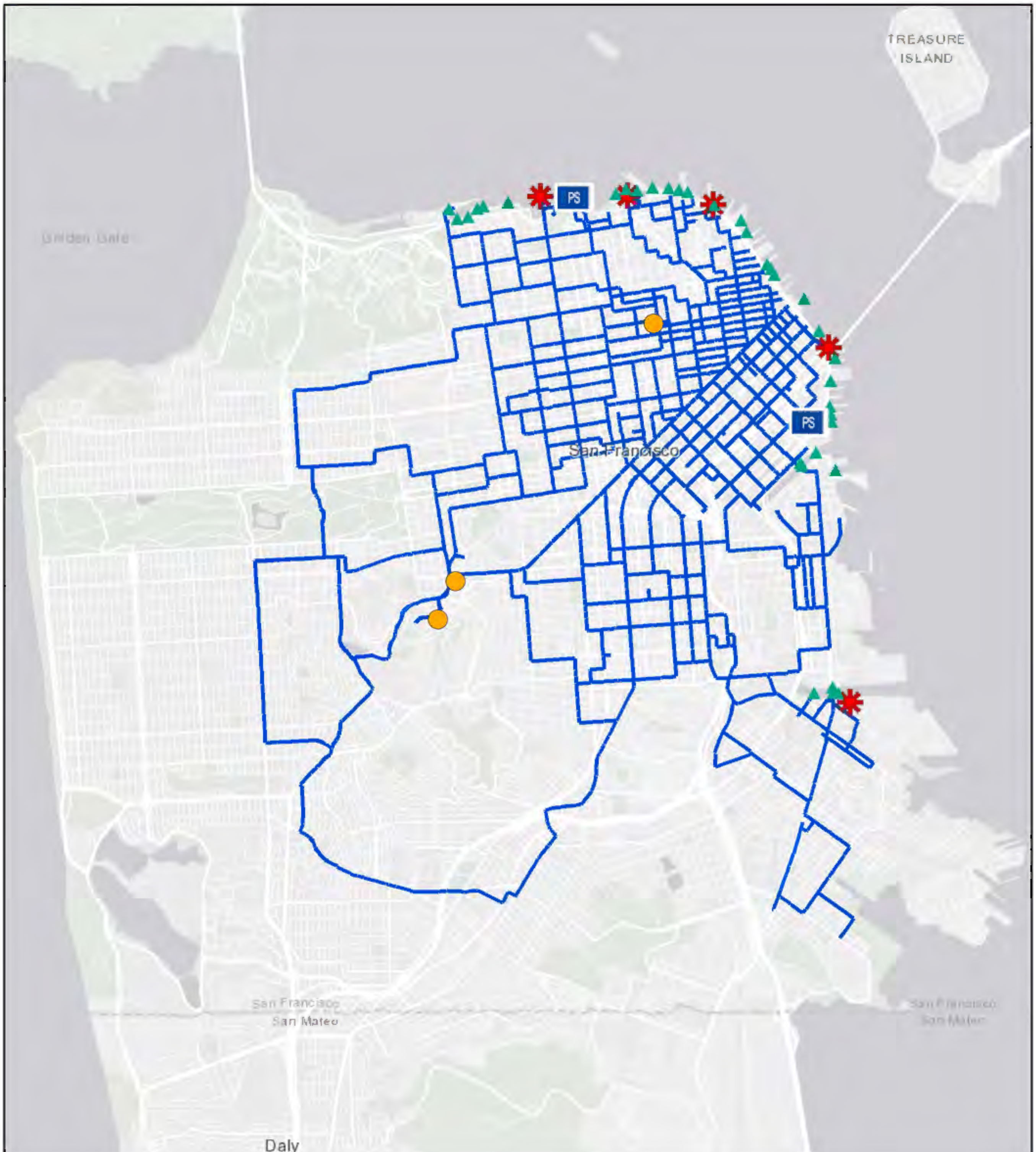
N

0 0.5 1 2 3 Miles

Legend

- PS AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- Cisterns
- AWSS Pipes

Appendix I



Existing EFWS - Pipelines

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

N

0 0.5 1 2 3 Miles

Legend

- PS AWSS Pump Stations
- AWSS Tank/Reservoirs
- Suction Connections
- Fireboat Manifold
- AWSS Pipes

Appendix J


N
Pacific Ocean
San Francisco Bay
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
Legend
Fire Response Area

Appendix K

Abstract

San Francisco is at significant risk due to fire following earthquake. This report analyses fire following earthquake for San Francisco as part of a larger project undertaken by the San Francisco Department of Building Inspection entitled Community Action Plan for Seismic Safety (CAPSS). This specific report, on fire following earthquake, has been conducted with the support and assistance of the San Francisco Fire Department (SFFD).

A stochastic model for analyzing fire following earthquake for San Francisco has been developed, utilizing data received from CAPSS, SFFD and others, to assess fire following earthquake impacts due to four earthquake scenarios: magnitude 7.9, 7.2 and 6.5 events on the San Andreas fault near San Francisco, and a magnitude 6.9 event on the Hayward fault. These events cause high ground motions in San Francisco that result in ground failure in many parts of the City – ground motions are particularly high in the western part of San Francisco, which was not yet built up in 1906 and therefore is not protected by the special high pressure SFFD Auxiliary Water Supply System (AWSS). Depending on the specific earthquake scenario, these ground motions and ground failures are estimated to cause over 1,000 breaks in the potable water system, so that SFFD's AWSS and cisterns will be the only source of firefighting water in many parts of the City. The AWSS itself will sustain some damage, forcing SFFD to fall back to cisterns only in some places. At the same time, SFFD's 42 fire engines will almost certainly not be able to respond to all the post-earthquake fires which are estimated to be about 100 on average (with a 10% chance of as many as 140) for the magnitude 7.9 San Andreas event. As a result, the methodology employed here estimates ignitions, building burnt areas and dollar losses for the four scenario events. These results are presented in Table A-1 as ranges within which losses will fall half (i.e., 50%) of the time (correspondingly, half the time the losses will be outside – that is, either more or less) than the indicated ranges.

Table A-1
Bounds for Losses to Buildings due to Fire Following Earthquake

	25% – 75% Confidence Range		
	Ignitions	**Loss** $ billions	**Total Burnt Building Floor Area** mill. Sq. ft.
San Andreas Mw 7.9	68 ~ 120	$ 4.1 ~ $ 10.3	11.2 ~ 28.3
San Andreas Mw 7.2	52 ~ 89	$ 2.8 ~ $ 6.8	7.7 ~ 18.6
San Andreas Mw 6.5	48 ~ 70	$ 1.7 ~ $ 5.1	4.7 ~ 14.0
Hayward Mw 6.9	27 ~ 46	$ 1.3 ~ $ 4.0	3.6 ~ 11.0

For example, for the Mw 7.9 event, essentially a repeat of the 1906 earthquake, losses will on average be about $7.6 billion, and half the time will be more than $4.1 billion and less than $10.3 billion. More detailed results are presented in the report, but the significance of these results is not in their precision, but rather in their overall magnitude. The model producing these results was validated by application to the 1989 Loma Prieta event, and examined for methodological and parametric sensitivity, with satisfactory results.

A number of opportunities exist for reducing the fire following earthquake in San Francisco, including further improvements in reliability of post-earthquake water supply, further support for NERT, and greater training for this problem for SFFD officers and firefighters.

Appendix L

Fire Protection Bonds

A

PROPOSITION A

FIRE PROTECTION SYSTEM IMPROVEMENT BONDS, 1986. To incur a bonded indebtedness of $46,200,000 for the improvement of the fire protection system within the City and County of San Francisco.

YES 273
NO 274

Analysis

by Ballot Simplification Committee

THE WAY IT IS NOW: Since the 1906 earthquake and fire, the San Francisco Fire Department has had programs to improve its fire protection system. A bond issue in 1977 paid for the most recent improvements, including an extension of the high pressure firefighting water system which operates independently from the City's domestic water supply. However, there are still parts of the City which are not served by that high pressure system.

THE PROPOSAL: Proposition A would authorize the City to borrow $46,200,000 by issuing general obligation bonds. This money would pay for improvements in San Francisco's fire protection system. These improvements would include extending the high pressure system, construction of new cisterns in residential areas, installation of a high pressure pump station at Lake Merced, construction of an emergency operations center, and other projects. The interest and principal on general obligation bonds are paid out of tax revenues. Proposition A would require an increase in the property tax.

A YES VOTE MEANS: If you vote yes, you want San Francisco to issue general obligation bonds totalling $46,200,000 to make certain improvements in the City's fire protection system.

A NO VOTE MEANS: If you vote no, you do not want San Francisco to issue bonds for these improvements in the City's fire protection system.

Controller's Statement on "A"

City Controller John C. Farrell has issued the following statement on the fiscal impact of Proposition A:

"Should the proposed Resolution be authorized and when all bonds shall have been issued on a twenty (20) year basis and after consideration of the interest rates related to current municipal bond sales, in my opinion, it is estimated that approximate costs would be:

Bond Redemption	$46,200,000
Bond Interest	38,808,000
Debt Service Requirement	$85,008,000

"Based on a single bond sale and level redemption schedules, the average annual debt requirement for twenty-two (22) years would be $3,864,000 which amount is equivalent to approximately one and twenty hundreths cents ($0.0120) in the current tax rate."

How "A" Got on the Ballot

On July 28 and August 4 the Board of Supervisors voted 8–0 in favor of the ordinance placing Proposition A on the ballot.

The ordinance was signed by Mayor Dianne Feinstein on August 6.

THE FULL LEGAL TEXT OF PROPOSITION A APPEARS ON PAGE 96

NOTE: YOUR POLLING PLACE MAY HAVE CHANGED. PLEASE REFER TO MAILING LABEL ON BACK COVER.

NO ARGUMENT WAS SUBMITTED AGAINST PROPOSITION A

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

In 1906, as dawn was about to break on April 18, a giant earthquake hit the City, touching off 52 separate fires. Those downtown swiftly joined in a huge conflagration that swept westward from the waterfront, leaving much of the City in ruins.

If another major quake strikes—(and seismic experts say it will, but they can't pinpoint when), the City must be prepared.

Our firefighters must have sufficient water to fight spreading fires and quickly to control them. That's the only way our City will survive.

In 1906, water mains broke and left the City defenseless.

Proposition A will assure adequate water in every neighborhood throughout the City.

Proposition A will provide $46 million in general obligation bonds to expand and improve emergency water supplies throughout the City. Residential areas will be provided with underground cisterns, and the high-pressure water supply system will be extended. Suction hose connections to City lakes, San Francisco Bay and the Pacific Ocean will provide additional millions of gallons of water.

These emergency fire-fighting water supplies are necessary to protect our homes, schools, hospitals, churches and other structures from the threat of fire that inevitably comes with a monstrous quake.

This increased fire protection will benefit the entire City and all who live, work and vist here.

Vote Yes on Proposition A.

Dianne Feinstein, Mayor

ARGUMENT IN FAVOR OF PROPOSITION A

As a result of the earthquake and fire in 1906, San Francisco suffered great destruction and devastation from the conflagration which followed, including the destruction of 28,000 buildings.

Due to broken water mains caused by the earthquake, the San Francisco Fire Department was unable to stop the fire from getting out of control.

Proposition A will provide for the expansion of a high pressure fire-fighting water system to the residential districts of the City, which will be critical in emergency situations.

Underground cisterns also will be constructed in the outer residential districts to provide emergency water supply in areas not served by the high pressure system.

High pressure system gate valves will be motorized with emergency battery powerpacks so they can be opened and closed in an emergency when normal power is disrupted.

Suction connections will be provided to San Francisco Bay, the Pacific Ocean, and City lakes so that fire department pumpers can quickly connect and pump water from these large bodies of water to any fires.

A pumping station for the high pressure system will be constructed at Lake Merced to provide an important source of water from the western part of the City.

An Emergency Operations Center will be built to provide a command center for operations in earthquakes and other major disasters.

The recent fire and explosion in the Hunter's Point district demonstrated the critical need for water supplies in a major fire. The broken water main caused by the explosion severely hampered the Fire Department in controlling this major fire. This is an example of what can happen when normal water supplies are disrupted.

Increased earthquake activity in California demonstrates the importance of this Proposition.

The fire department can function only if an adequate water supply exists. Proposition A will provide an emergency fire-fighting water supply for the City, and ensure that fires will not get out of control due to lack of water, following an earthquake.

We urge all citizens to vote yes on Proposition A. This is protection for your home and your City.

—Submitted by the Board of Supervisors

ARGUMENT IN FAVOR OF PROPOSITION A

The Fire Commission and Chief of Department urge a YES vote on Propositon A—a $46.2 million Earthquake Preparedness Program.

This construction Program is designed to provide an updated and expanded emergency water supply system so that all areas of the City and County of San Francisco will be protected in case of a conflagration following an earthquake or other disaster.

The major components of the Program are: high-pressure water supply extensions, underground cisterns, pumping station, emergency operations center, suction hose connections to the Bay and lakes, and a study to determine fire station reconstruction needs and their earthquake safety.

Help the San Francisco Fire Department provide increased fire protection. **VOTE YES ON PROPOSITION A.**

Henry E. Berman, President, Fire Commission
Curtis McClain, Vice President, Fire Commission
Juanita Del Carlo, Commissioner, Fire Commission
Richard J. Guggenhime, Commissioner, Fire Commission
Anne S. Howden, Commissioner, Fire Commission
Emmet D. Condon, Chief of Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans will not forget, nor should they, the tragic Bayview/Hunter's Point fire on April 4, 1986. Coincidentally, two earthquakes rocked the Bay Area in the weeks following the Bayview fire.

Following the Bayview fire, I requested Board of Supervisors hearings to investigate the adequacy of San Francisco's emergency water supply in the Bayview, Ingleside, Balboa Terrace, Oceanview, Lakeside, Forest Hill, Crocker-Amazon, St. Francis Wood, West Portal, Diamond Heights, Visitacion Valley, Merced Manor, Excelsior, Portola, Silver Terrace, Miraloma Park, Forest Knolls, Inner Sunset, Lakeshore Acres, Monterey Heights, and Outer Mission neighborhoods, and to implement a program to correct deficiencies in our emergency firefighting capabilities. From these hearings and deliberations of the Fire Commission, Proposition A emerged.

VOTE YES ON A.

Proposition A is a $46,200,000 general obligation bond issue to construct a comprehensive emergency water supply system and an emergency operations center for firefighting in the event of a disaster.

That may seem like a lot of money, but it represents, in this case, a prudent, far-sighted investment in San Francisco's future. Unfortunately, we can't guarantee another Bayview-type fire won't happen. But we can be better prepared if one does happen, and significantly reduce the risk to life and property in the Bayview, Hunter's Point, the Outer Mission, and all of the West of Twin Peaks area.

Please vote "Yes" on A.

Quentin L. Kopp, Supervisor

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquakes are a major concern to all of us who live in California, and a potential cause of disaster for San Francisco. Following a major earthquake it is highly likely that multiple fires will occur. San Francisco with its highly congested blocks of wooden buildings would face a conflagration (fire storm), if a major earthquake caused water supplies to be disrupted.

Proposition A, as an Earthquake Preparedness measure, is very important for San Francisco. It will provide for Emergency Water Supply necessary for fire fighting.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Bruce Bolt, Professor of Seismology
Karl V. Steinbrugge, Past Chairman
California Seismic Safety Commission
Charles Scawthorn, Structural Engineer
Joe J. Litehiser, Seismologist
Donald H. Cheu, M.D., Vice Chairman
Governor's Earthquake Task Force

ARGUMENT IN FAVOR OF PROPOSITION A

We support this important Earthquake Preparedness Program.
VOTE YES ON PROPOSITION A.

Willie L. Brown, Jr., Speaker of Assembly
Michael Hennessey, Sheriff
Morris Bernstein, President, Airports Commission
Douglas Engmann, Commissioner, Board of Permit Appeals
E. L. Friend, President
Anne Halstead, Commissioner, Port Commission
Thomas E. Horn, President, War Memorial Board of Trustees
Melvin D. Lee, Commissioner, Redevelopment Commission
Robert J. McCarthy, Vice President, Board of Permit Appeals
Al Nelder, Commissioner, Police Commission
Michael Salarno, Member, S.F. Parking Commission
William K. Coblentz, Attorney
Gordon J. Lau, Attorney
Steven L. Swig, Attorney

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection for San Francisco's neighborhoods is a vital factor. Emergency Water Supplies for fire fighting are necessary so that the Fire Department can provide ample protection to our homes in the event an earthquake damages water mains as occurred in 1906.

Proposition A will expand and improve the Fire Department's Emergency Water Supplies.

- Suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- Underground cisterns will be provided in residential areas.
- The High-Pressure System will be extended to outer residential districts.

The cost of Proposition A is .0120 cent per $100 valuation on the property tax; this means a home valued at $150,000 would pay $17.16 per year for this protection. This is highly cost effective insurance for our homes.

We urge all citizens to **VOTE YES ON PROPOSITION A.**

Marguerite A. Warren
James J. Walsh, Jr.
Dorothy Agnes McDougall
Andrew Jones
George L. Newkirk
Jess T. Esteva
Dolph Andrews
Norman V. Wechsler

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection and Earthquake Preparedness concern all school officials in San Francisco.

Proposition A is an important program that will provide **Emergency Water Supplies For Fire Fighting** throughout the City.

When a major earthquake strikes, the Fire Department must have a dependable water supply to protect our families, homes and schools.

Earthquakes cannot be stopped, but we must have water to stop the fires that will occur.

We ask all citizens to join us and **VOTE YES ON PROPOSITION A.**

Myra A. Kopf, President, Board of Education
A. Richard Cerbatos, Vice President, Board of Education
Libby Denebeim, Member, Board of Education
JoAnne Miller, Member, Board of Education
Benjamin Tom, Member, Board of Education
Sodonia M. Wilson, Member, Board of Education
Rosario Anaya, Member, Board of Education
Ernest C. Ayala, President, S.F. Community College Board
Al Vidal, Principal, Washington High School

ARGUMENT IN FAVOR OF PROPOSITION A

Improved and expanded Emergency Water Supplies for fire fighting in San Francisco are a necessary factor to prevent another conflagration (fire storm) from sweeping the City as occurred in 1906.

Our central business and financial districts are the economic heart of the City, the residential districts contain the homes of our citizens.

Proposition A provides increased fire protection to our high-rise buildings and our homes.

Earthquake preparedness and protection from the ravages of fire concern us all. As civic leaders of San Francisco we urge all citizens to **VOTE YES ON PROPOSITON A.**

Lee Dolson, General Manager, Downtown Association
James R. Bronkema, President, Embarcadero Center

ARGUMENT IN FAVOR OF PROPOSITION A

We can bet that most of you have seen the circles of bricks encompassing certain intersections in some neighborhoods in San Francisco. These circles mark underground water cisterns that were constructed "after" the devastating earthquake and fire in 1906. Many neighborhoods in San Francisco built after 1912 are NOT serviced by this alternate water system.

Proposition A would provide a City-wide emergency water supply system to protect our homes and neighborhoods.

We cannot prevent earthquakes but we can take precaution against fire. . .the biggest threat to San Francisco.

We urge a **YES** vote on Proposition A. . . fire protection for our families no matter where they may be in our City.

Nancy Honig
Roxanne Mankin
Jane McKaskle Murphy
Bernice E. Ayala
Cheryl Arenson
Gina Moscone
Jonnie B. Johnson

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and increased fire protection are of vital concern to all citizens of San Francisco.

VOTE YES ON PROPOSITION A.

Robert Bacci
Michael Bernick
Susan Bierman
Frank T. Blackburn
Rev. Dr. Amos C. Brown
Sally Brunn
Stafford Buckley
Michael Chan
Charles D. Cresci
Rosemary DeGregorio
Todd Dickinson
H. Welton Flynn
Ron Huberman
Ralph Hurtado
David Jenkins
Agar Jaicks
Carole Migden
Polly V. Marshall
Alicia Wang
Thomas F. McDonough
Tony Kilroy
Leroy King
David Looman
Christopher Martin
Peter Mezey
Marilyn Miller
Jeff Mori
Sandy Mori
Yoshio Nakashima
Mitchell Omerberg
Edward J. Phipps
Linda Post
Thelma Shelley
Robert J. Tully
Yori Wada
Evelyn Wilson
Pansy Ponzio Waller
Bruce W. Lilienthal
Jim Wachob

ARGUMENT IN FAVOR OF PROPOSITION A

Pure self interest dictates that we provide an abundant and surplus supply of "fire protection" water for EVERY part of San Francisco, not just half of it! VOTE YES!

W. F. O'Keeffe, Sr., San Francisco Taxpayers Association

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Fire Protection Bonds (A)

ARGUMENT IN FAVOR OF PROPOSITION A

Emergency water supplies for fire fighting are vital for San Francisco. On April 4, 1986, an explosion and fire occurred in the Bayview District, causing nine deaths. The disrupted water supply caused by the explosion, severely hampered the Fire Department in controlling this fire.

In the event of a major earthquake it is highly likely that water mains will be damaged throughout San Francisco. Proposition A will provide for 94 underground cisterns to be built in residential areas where few emergency water supplies now exist. The Bayview fire demonstrated the need for emergency water supplies for fire fighting.

Protect your neighborhood and home.

VOTE YES ON PROPOSITION A.

Concerned Citizens for Improved Fire Protection

Michael Frew, Chairman
John Holt
Robert L. Kreuzberger
Ed F. Patterson
Michael S. Newman
Mel S. Newman
Jack R. Brower
August J. Nevolo

ARGUMENT IN FAVOR OF PROPOSITION A

San Franciscans remember what happened in 1906. The fires that occurred after the earthquake swept the City and left many thousands of people homeless.

Proposition A is a common sense program to provide **Emergency Water Supplies for Fire Fighting** throughout the City. This would ensure that fires would not get out of control due to lack of water supply.

This $46.2 million bond issue needs a two-thirds vote. As a former member of the Board of Supervisors and neighborhood businessman, I urge all citizens to vote for this important program. It is protection for your family, home and city at a very low cost; it makes sense in both human and economic terms.

VOTE YES ON PROPOSITION A.

John Barbagelata, Realtor

ARGUMENT IN FAVOR OF PROPOSITION A

Proposition A assures San Francisco residents of on-going preparation which is the best defense against a major disaster—earthquake, conflagration, or an explosion.

San Francisco Fire Fighters regard this measure as the first-step in the earthquake preparedness program.

Control disaster with expanded fire protection!

San Francisco Fire Fighters urges a **YES** vote on Proposition A.

James T. Ferguson, President,
San Francisco Fire Fighters Local 798

ARGUMENT IN FAVOR OF PROPOSITION A

Fire Protection is a serious concern for all citizens of San Francisco. We, the working Fire Chiefs of San Francisco are well aware of what happened in 1906, when fires occurring after the great earthquake burned thousands of buildings and left over 200,000 homeless.

The quake caused hundreds of breaks in water mains and the lack of water supplies prevented the Fire Department from controlling the fire.

We do not want this to happen again.

Proposition A will provide **Emergency Water Supplies for Fire Fighting.** The following installations will be placed in our neighborhoods to protect our homes.

- 94 underground cisterns will be built.
- 56 suction hose connections for pumpers will be provided to City lakes, S.F. Bay and Pacific Ocean.
- The High-Pressure System will be extended to residential areas.
- Improvements to tanks, reservoirs, pump stations, including a new pump station at Lake Merced and an Emergency Operations Center.

The recent fire in the Bayview District that took nine lives demonstrated how important water supplies can be. The damaged water supply caused by the fire and explosion seriously hampered Fire Department efforts to control this major fire.

We as the working Fire Chiefs who actually run the day-to-day field operations in San Francisco urge all citizens to support this important measure.

VOTE YES ON PROPOSITION A.

John W. Flaherty
President, The San Francisco Fire Chiefs Association
Gary J. Torres
Secretary, The San Francisco Fire Chiefs Association

ARGUMENT IN FAVOR OF PROPOSITION A

Fire safety can be improved by voting FOR Proposition A and AGAINST BART director Eugene Garfinkle. BART's a fire trap.

Tom Spinosa, BART Board candidate

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

A Fire Protection Bonds

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and Fire Protection are vital factors for all citizens.

VOTE YES ON PROPOSITION A.

A. Cecil Williams, Glide United Methodist Church
Bob Barry, President, S.F. Police Officers Association
William Corvin, President, California Steam Company
J. M. Eaneman, President, AMC Cancer Research Board of Directors
George Foos, Chairman, Great Western Value Centers
Rev. John L. Green, Chaplain, S.F. Fire Department
Albert S. Samuels, Jr., Past President, Market Street Project
Harvey Matthews, Bayview-Hunter's Point Democratic Club
Arthur Goedewaagen, President, Sunset-Parkside Education & Action Committee

ARGUMENT IN FAVOR OF PROPOSITION A

Prior to the Great Earthquake and Fire of 1906, San Francisco Fire Chiefs had always insisted the City was not prepared for a major disaster. History proved them correct. Today, 80 years later, San Francisco's preparation is still not adequate.

When each of us was Chief of Department, we emphasized the need for the additional preparedness necessary to prevent a sweeping fire storm or catastrophic disaster. That state of preparedness has yet to be attained. However, Proposition A offers a once-in-a-life opportunity to protect life and property, through preparation, at an extremely minimal cost. This opportunity should not be missed.

Proposition A will provide the necessary water supplies vital to preventing another conflagration of the 1906 magnitude!

Proposition A will expand the high-pressure firefighting water supply system beyond the commercial areas into the residential neighborhoods!

Proposition A will greatly improve fire defenses not only in the western part of San Francisco but City-wide as well!

Proposition A will ensure that San Francisco is no longer one of the few remaining major cities with a sub-standard Emergency Operations Center for command and control during disasters and earthquakes!

As former San Francisco Fire Chiefs, we urge you to **VOTE "YES" ON PROPOSITION A.**

William F. Murray, Chief, San Francisco Fire Department, Retired
Keith P. Calden, Chief, San Francisco Fire Department, Retired
Andrew C. Casper, Chief, San Francisco Fire Department, Retired

ARGUMENT IN FAVOR OF PROPOSITION A

- Yes on Proposition A.
- Local fire chiefs have warned about grave BART fire catastrophe dangers. End disregard of public safety.

—San Franciscans for BART Safety

ARGUMENT IN FAVOR OF PROPOSITION A

This is a vital issue for San Francisco. **Emergency Water Supplies for Fire Fighting** must be provided throughout the City.

Many fires will occur if a major earthquake strikes San Francisco.

The Fire Department needs a water suply to prevent a conflagration (fire storm) from occurring again, as it did in 1906.

Earthquakes are a geologic fact of life and cannot be prevented, but we can prepare for the fires that will occur, this makes sense for all citizens.

VOTE YES ON PROPOSITION A.

Philip S. Day, Jr.
Director, San Francisco Office of Emergency Services
Richard Eisner, Earthquake Preparedness Consultant
Jelena Pantelic, Chairperson, Disaster Preparedness Committee
Joe Posillico, Emergency Services, Salvation Army
Peter Ashen, Disaster Director, American Red Cross

ARGUMENT IN FAVOR OF PROPOSITION A

San Francisco Council of Civic Organizations endorsements:
Proposition A—YES
Proposition M—YES

Terence Faulkner
President, San Francisco Council of Civic Organizations

ARGUMENT IN FAVOR OF PROPOSITION A

Earthquake Preparedness and providing Emergency Water Supplies for Fire Fighting are of vital importance to San Francisco.

VOTE YES ON PROPOSITION A.

Donald J. Birrer, Director of Public Works
Frank M. Jordan, Chief of Police
Dean Macris, Director of Planning
Rudy Nothenberg, General Manager, Public Utilities
William Stead, General Manager, Municipal Railway
David Werdegar, M.D.M.P.H., Director of Public Health
James D. Cooney, General Manager, S.F. Water Department

Arguments printed on this page are the opinion of the authors and have not been checked for accuracy by any official agency.

Appendix M

FIRE COMMISSION

City and County of San Francisco

Gavin Newsom, Mayor

Victor Makras, *President*
Stephen A. Nakajo, *Vice President*
George Lau, *Commissioner*
Andrea Evans, *Commissioner*

698 Second Street
San Francisco, CA 94107
Telephone 415.558.3451
Fax 415.558.3413
Monica Quattrin, *Commission Secretary*

SAN FRANCISCO FIRE COMMISSION

RESOLUTION 2010-01

ENCOURAGING THE FIRE DEPARTMENT TO PURSUE GRANT FUNDING IN THE AMOUNT OF $9.785 MILLION FROM THE FEDERAL GOVERNMENT, TO EXPAND THE DEPARTMENT'S PORTABLE WATER SUPPLY SYSTEM.

WHEREAS, The uniformed employees of the San Francisco Fire Department (SFFD) respond to approximately 100,000 incidents a year; and,

WHEREAS, It is the responsibility of the SFFD and its members to protect the lives and property of the citizens of San Francisco from the effects of natural disasters; and,

WHEREAS, The United States Geological Survey has issued increasingly frequent warnings of the high probability of a potentially catastrophic earthquake in the San Francisco Bay Area during the next thirty years; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the destructive effects of earthquakes on underground infrastructure, have identified the domestic water system of San Francisco as highly vulnerable to catastrophic failure in the event of a major Bay Area earthquake; and,

WHEREAS, World renowned scientists, whose area of expertise is the modeling of the spread of fire following earthquakes in modern urban settings, have predicted that there is a high likelihood that San Francisco will be subject to multiple simultaneous conflagrations following a major Bay Area earthquake; and,

WHEREAS, The assessed value of the real estate in San Francisco subject to property taxation exceeds $100 billion; and,

WHEREAS, The spread of fire following earthquakes in a modern urban setting typically is responsible for as much as 75% of the total dollar loss that results; and,

WHEREAS, Loss of life following an earthquake in a modern urban setting is greatly exacerbated by the effects of resultant fires in buildings where occupants have been trapped by structural collapse; and,

WHEREAS, The Auxiliary Water Supply System does not cover the entire geographic areas of the City and County of San Francisco; and,

WHEREAS, The SFFD's Portable Water Supply System has been proven effective in the above-ground transmission of water for fire fighting purposes; and,

WHEREAS, The Portable Water Supply System works in conjunction with and can supplement the existing Auxiliary Water Supply System, and therefore the Portable Water Supply System is capable of partially mitigating the possible lack of domestic water system availability following a major earthquake; and,

WHEREAS, the number of units currently comprising the SFFD's existing Portable Water Supply System is not adequate to supply all areas of San Francisco where the Auxiliary Water Supply System does not extend; and

WHEREAS, the proposed design for expanding the Portable Water Supply System has been shown to be a highly cost effective and functionally adaptable method of providing the means by which firefighters can attack multiple conflagrations simultaneously;

WHEREAS, the SFFD is working with Senator Dianne Feinstein and Speaker of the House Nancy Pelosi in seeking these grant funds, now therefore, be it

RESOLVED, That the Fire Commission encourages the Fire Department to actively pursue grant funds in the amount of $9.785 million from the Federal government, to expand the Portable Water Supply System and train SFFD uniformed members, the Fire Reserve, and other members of the community who may assist the SFFD in times of disaster.

Adopted at the Regular Meeting of the San Francisco Fire Commission on January 14, 2010.

Ayes: 4 (Makras, Nakajo, Lau, Evans)
Nays: 0

Monica Quattrin

Monica Quattrin, Commission Secretary

Appendix N

Frequently Asked Questions - Fire Suppression Water Systems

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

1) What is the Auxiliary Water Supply System, and what is its primary function?

The Auxiliary Water Supply System (AWSS) is a non-potable fire-suppression water system that was built the decade following the catastrophic 1906 San Francisco earthquake. The purpose of the AWSS is to provide the San Francisco Fire Department (SFFD) with a high-pressure fire suppression water system that can be utilized during large fires. The system is vital for protection against the loss of life, homes, and businesses from fire following an earthquake and non-earthquake multiple-alarm fires.

There are two aspects of the AWSS that are critical to its success:

1. Distribution infrastructure: The AWSS consists of over 135 miles of high-pressure pipeline and hydrants. The system utilizes approximately 30 seismically-reliable motorized valves, allowing the SFPUC to valve off sections of the system, to ensure that pressure is maintained in areas where fires are occurring.
2. The water supply that feeds into the AWSS distribution infrastructure. The primary source of the AWSS is the SFPUC's Hetch Hetchy Water System.

The original AWSS system consisted of three reservoirs and two seawater pumping stations. Their capacities:

- 10.5 million gallon Twin Peaks Reservoir,
- 0.5 million gallon Ashbury Heights Tank, and
- 0.75 million gallon Jones Street Tank.
- Seawater pump station #1: 10,000 GPM (located in SOMA)
- Seawater pump station #2: 10,000 GPM (located near Aquatic Park)

In 2010, the management of the AWSS was transferred to the San Francisco Public Utilities Commission (SFPUC). A shared goal of the SFPUC and SFFD is doing the following to expand and improve the reliability of the water supply serving the AWSS. The agencies have undertaken the following to do so:

- 95% completion of the $4.8 billion Water System Improvement Program (WSIP), providing robust seismic upgrades to the pipelines, reservoirs, and infrastructure that supply water to San Francisco and the greater Bay Area;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;

- Analyzing the usage of the 90 million gallon North Basin of Sunset Reservoir as a water Supply for a Potable AWSS in the Sunset and Richmond Districts; and
- Investigating the installation of a seawater pump station at Ocean Beach to serve as a secondary source of water for fire suppression for the Sunset and Richmond Districts.

In addition to the AWSS, the SFPUC's low-pressure drinking water system and its low-pressure hydrants, as well as approximately 180 cisterns throughout San Francisco, can be pumped and utilized by SFFD Fire Trucks for fire-suppression.

2) Is the AWSS located throughout San Francisco? If not, why?

The AWSS was built after the 1906 earthquake, and its location, primarily in the northeast portion of San Francisco, corresponds to the location of the central business district and the majority of the city's population at that time.

The San Francisco Public Utilities Commission (SFPUC), SFFD, and San Francisco Public Works (SFPW) are committed to increasing fire protection throughout San Francisco. Since the passage of the Earthquake Safety and Emergency Response Bond in 2010, the three agencies have been implementing projects to improve the system's seismic reliability and range of coverage. The three agencies will continue to implement projects utilizing new and proven technologies that improve upon the original system design. There have been many advancements in earthquake resistant pipeline design and materials, hydrants, and seismic valves since the early 1900s, and the SFPUC intends to use the best possible technology available to meet the performance standards of the SFFD. Please standby for future updates to the SFPUC webpage for images, graphics, and maps showcasing the original AWSS system, recent upgrades, and future projects.

3) Who manages the AWSS, the SFPUC or the SFFD? How does the SFFD know that the AWSS system is being adequately and reliably maintained?

The SFFD owned and managed the AWSS and the fire hydrants on the potable water system from the early 1900s until 2010. During this time the SFFD collaborated with staff from San Francisco Public Works (SFPW) to implement upgrades to the system. In 2010, the AWSS was transferred to the SFPUC, the City's experts in water supply piping systems. By bringing in the SFPUC to work with SFFD and SFPW, City leaders created an interagency team with all of the expertise needed to manage, operate, and update the AWSS.

The SFFD is considered the end user of the system, and therefore system improvements and expansion completed by SFPUC must meet the rigorous and high-quality standards of the SFFD. The SFFD and SFPUC meet monthly to discuss operations of the AWSS, report on maintenance activities, review capital and developmental project design and status, and communicate on policies and procedures that affect both departments.

This partnership presents the best of both worlds for San Franciscans. The women and men of SFFD are internationally-recognized for their expertise, experience, and bravery in fighting fires. Similarly, the SFPUC, with its Hetch Hetchy Water System, is recognized as one of the top water agencies in the world. The SFPUC has hundreds of engineers that are experts in designing, expanding, and improving water systems. Additionally, the SFPUC has over 80 plumbers and dozens of construction management experts in-house that are dedicated to providing high-quality maintenance and oversight of the construction projects needed to keep the AWSS functioning for the SFFD's use.

With the two agencies working together, in partnership with SFPW, the City of San Francisco has the experts it needs to successfully operate, expand, and improve the AWSS.

4) What are the SFPUC and SFFD doing to increase fire protection in the areas of the City that do not have the AWSS?

When the SFPUC took over control of the system, the agency worked with SFFD to complete a review of all existing facilities and a comprehensive Planning Study.

The analysis modeled the hydraulic reliability of the existing AWSS after a major earthquake. In this context of this study, hydraulic reliability is defined as the percentage of the water needed by SFFD to fight fires that would be met by the AWSS and other sources after a 7.8 earthquake on the San Andreas Fault.

Our analysis showed that the 2010 AWSS was 47% reliable, and thus only able to provide about half of the water needed for city-wide firefighting following a 7.8 earthquake. Utilizing this information, the SFPUC, SFFD, and SFPW identified projects that would increase system reliability and could be funded by the 2010 and 2014 Earthquake Safety and Emergency Response (ESER) Bonds authorized by San Francisco voters. Decisions on which projects to implement utilizing bond funds are based on a given project's ability to improve the reliability score for the Fire Response Area that the given project serves and to increase the likelihood of delivering water after an earthquake.

Bond-funded projects make seismic upgrades to the system and repair, replace, and extend system components to increase the ability to provide adequate water for firefighting. Funding is allocated to repair, replace, and extend system components to improve the ability to provide adequate water for firefighting purposes following a major earthquake and during multiple-alarm fires from other causes. This includes repairs and upgrades to core facilities, pipelines, and tunnels, and construction of new cisterns.

The following projects have been completed utilizing the funds from the 2010 and 2014 bonds:

- Installation of 30 new cisterns (with 15 of these cisterns installed in the Sunset and Richmond districts);
- Reliability upgrades at the three primary source supplies – Twin Peaks Reservoir, Ashbury Heights Tank, and Jones Street Tank;
- Added a larger pipe to increase the speed of re-filling the Twin Peaks reservoir from the 11 million gallon Summit Reservoir;
- Replaced the engines and installed remote control capabilities for Seawater pump station #1 to allow for remote operation;
- 6 pipeline and tunnel projects.

The following projects are in construction and/or design phase:

- Connecting the 70 million gallon South Basin of the University Mound Reservoir to AWSS (expected completion in 2018);
- 16 pipeline and tunnel projects;
- Motorizing critical seismically-reliable valves for remote control, and improving the electronic control system of the valves; and
- Structural and seismic upgrades of Seawater pump station #2 (expected completion in 2020);
- Designing the installation of a pump station at Lake Merced to feed into the AWSS in the future if funding is available;
- Preliminary analysis for a Potable AWSS for the Sunset and Richmond Districts. *Additional information on that system can be found in questions 6-11.*

Once fully completed, the projects implemented with the ESER 2010 bond funds will increase the citywide reliability score from 47% to 67%. The full completion of the projects implemented with the ESER 2014 bond funds will increase the citywide reliability score from 67% to 87%. Construction of additional recommended future projects will increase the citywide reliability score to 96%.

5) Who makes decisions about the selection and implementation of AWSS projects? Who reviews the progress and implementation of AWSS capital projects?

Overseeing the selection and implementation of AWSS projects is the Management Oversight Committee consisting of SFPUC General Manager Harlan Kelly, SFFD Chief Joanne Hayes-White, SFPW Director Mohammed Nuru, and SFPUC Assistant General Manager of Water Steve Ritchie.

The San Francisco Capital Planning Committee, consisting of the City Administrator and including the President of the Board of Supervisors, the Mayor's Budget Director, the Controller, the City Planning Director, the Director of Public Works, the Airport Director, the Executive Director of the Municipal Transportation Agency, the General Manager of the Public Utilities System, the General Manager of the Recreation and Parks Department, and the Executive Director of the Port of San Francisco, reviews the progress and implementation of AWSS capital projects. Capital Planning Committee meetings are open to the public. Please find more info at the Committee's webpage.

6) Are the SFPUC and SFFD looking at something called a Potable AWSS for fire suppression on the Westside of San Francisco. What is a Potable AWSS? How does it function? How is it different from the existing AWSS?

The word "potable" is defined as "safe to drink". The Potable AWSS currently under analysis will connect to the 90 million gallon North Basin of the Sunset Reservoir, and will provide a high-pressure firefighting system for the SFFD to fight fires in the Richmond and Sunset Districts. **The Potable AWSS will meet the same rigorous standards required by SFFD to fight large fires, and will utilize the same earthquake resistant pipes, seismically-reliable valves, hydrants, and components utilized by the AWSS, and therefore will be designed to function at the high-pressure level required by SFFD.** The Potable AWSS project is currently in the planning and analysis phase. The SFPUC will work with SFFD to design the system with operational capabilities and design criteria standards equal to or exceeding the existing AWSS.

The Potable AWSS will also have roughly 5 connections to potable water pipes in the Sunset and Richmond districts. **These connections will utilize the same valves as the 30 valves the existing AWSS currently uses to isolate sections of the AWSS to maintain system pressure.** Additionally, these 5 valves will be tested at the same schedule as the existing valves to ensure their performance during an incident. During non-fire events, the Potable AWSS pipeline will be one of many pipes supplying drinking water to the Richmond and Sunset districts.

In the event of a major fire, the approximately five isolation valves will be closed automatically, remotely, or manually, which are the same methods that the 30 valves on the existing AWSS utilize. These five isolation valves will be closed so that the Potable AWSS will be disconnected from the City's low-pressure water system and therefore can provide reliable high-pressure water for fire-fighting. If the Potable AWSS is isolated for firefighting use, homes and businesses will continue to be served by other redundant low-pressure drinking water distribution pipes, assuming that those low-pressure pipes have not incurred numerous breaks and leaks during the earthquake.

An additional benefit of the Potable AWSS is that it will be designed and constructed to meet required AWSS performance standards, and the system will be rated to meet drinking water standards. This means that after firefighting following an earthquake, the Potable AWSS will be able to provide drinking water to the Sunset and Richmond Districts even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

7) Does the Potable AWSS provide an equivalent amount of fire suppression when compared to the existing AWSS? Does the Potable AWSS provide the water pressure and supply of water needed by SFFD to fight small and large fires?

Yes. The Potable AWSS will be designed to meet all SFFD performance requirements. The SFFD will not reduce or lower their robust performance standards, and therefore the SFPUC must design, construct, maintain, and operate the Potable AWSS system to meet these standards. The SFPUC is currently working in conjunction with SFFD to design a system that will have pressure and performance capabilities equal to or exceeding AWSS.

8) Does the Potable AWSS use the same type of earthquake resistant piping and valves as the AWSS?

Yes. The Potable AWSS will use earthquake resistant piping that is equal or better than the current AWSS piping design standard. Additionally, the Potable AWSS will utilize the same seismically-reliable valves as the 30 existing valves currently utilized by the AWSS to isolate sections of the system to ensure supply reliability in areas with fires. The hydrants utilized will also be the same as the existing AWSS. All of these components will be able to property function at the high-pressure levels required by SFFD.

9) The Potable AWSS relies on automatic valves to boost the water pressure to the level needed to fight big fires. What if the automatic valves fail, will SFFD be without the water they need to fight big fires? Does the existing AWSS rely on these automatic valves to fight fires? Does the Potable AWSS rely on more of these valves than the existing AWSS?

The potable AWSS will be isolated after an earthquake from the remainder of the distribution system by seismically-reliable motorized valves using the same method and equipment as current AWSS valves. All valves, future and existing, have redundant safeguards and a maintenance program that will ensure their performance. The valves can be operated manually if the valve actuators fail, just like the existing AWSS motorized valves. The valves are utilized by the existing AWSS and the future Potable AWSS to isolate sections of pipe to ensure that the systems provide the water supply and pressure needed by SFFD to fight big fires.

The quantity of the motorized valves on the future Potable AWSS will be dependent on the length of the Potable AWSS pipeline constructed, but is anticipated to be approximately 5 valves.

10) Are there other cities that have implemented a Potable AWSS? Or do other cities utilize systems similar to the existing AWSS?

Only one other city in the world, Vancouver, B.C. Canada, has been identified as having an isolated secondary firefighting system similar to the existing AWSS. Vancouver's system is less than 10 miles in length, while ours has over 135 miles.

To our knowledge, all other cities rely on their low-pressure potable water system and hydrants for fire-fighting. In Japan, a country that has similar seismic risk to that of San Francisco, cities utilize a system similar to the proposed Potable AWSS. The Japanese system is designed similar to our proposed Potable AWSS – for fighting a large fire after an earthquake, seismically-reliable water transmission mains and hydrants are isolated from the rest of the distribution system using seismically-reliable valves. This allows the Japanese's seismically reliable mains to be increased in pressure and used for fire-fighting. After the fires are suppressed, the Japanese system is used to provide drinking water to residents and businesses.

Recently a team of Japanese water engineers came to San Francisco to showcase the success of their piping system and their experience using Kubota pipes to SFPUC and SFFD staff. The Japanese team highlighted the success of their system and its piping in its utilization after earthquakes to fight fires.

Japan's successful implementation and use of a system similar to the proposed Potable AWSS showcases that the approach and technology do work in fighting fires after a major earthquake.

11) Is the SFPUC is proposing to fill the Potable AWSS from Sunset Reservoir. How much water is in Sunset Reservoir?

The North and South Basins have a combined capacity of 176 million gallons. The North Basin, with a capacity of 90 million gallons, will be connected to the Potable AWSS. The North Basin recently underwent a $64 million seismic upgrade, and is designed to withstand a 7.9 San Andreas Fault earthquake. It can be isolated from the South Basin, and therefore all 90 million gallons could be used for firefighting purposes.

12) Can Sunset Reservoir provide enough water for SFFD and civilian use during a fire? How long will the water in Sunset Reservoir last if it the reservoir is unable to be re-filled by the SFPUC's Hetch Hetchy Water System, the SFFD is utilizing the Potable AWSS to fight a fire, and civilians are utilizing the reservoir?

If firefighting requires a flow of 14,000 gallons per minute for the Sunset and Richmond districts, the 90 million gallon water supply in the North Basin of Sunset Reservoir will last for 4.5 days. This assumes that no additional water is added from the Hetch Hetchy Water System, which is **very** unlikely. Please see question #12 for additional info.

During an emergency situation, the South basin of Sunset Reservoir will be isolated from the North Basin, allowing the North Basin to be used solely for firefighting purposes. The 86 million gallon South Basin will still be connected to the City's low-pressure drinking water distribution piping system so that residents and businesses can receive drinking water while fires are being fought. In an Earthquake situation, residents and businesses may not receive continuous drinking water from the South Basin as fires are being fought, if there are breaks and/or leaks in the low-pressure drinking water pipes that connect to the South Basin. After the fires are put out, the Potable AWSS, connected to the North Basin, will be able to provide drinking water to the Sunset and Richmond Districts, even if the City's low-pressure drinking water distribution system incurs numerous breaks and leaks.

13) Will Sunset Reservoir be able to function after an earthquake? How long will it take for the water supplying Sunset Reservoir to arrive to the reservoir if there is a major earthquake?

In 2008, seismic improvements to the North Basin of Sunset Reservoir were completed for $64 million under the SFPUC's Water System Improvement Program (WSIP). Also under the WSIP, seismic improvements were made on the pipelines leading to Sunset Reservoir. **Thus, it is anticipated that the reservoir can be replenished from the Hetch Hetchy Water System within 24 hours of a major seismic event. Therefore, the Hetch Hetchy Water System will be able to re-fill the North Basin of the Sunset Reservoir prior to the Potable AWSS draining it after 4.5 days of use.**

The Hetch Hetchy Water System consists of 9 reservoirs, capable of supplying up to 265 million gallons of water per day. The WSIP includes $4.8 billion in upgrades to the system, increasing its seismic reliability and ability to provide water to the Bay Area after a large earthquake.

14) The Pacific Ocean is right next to the Westside of San Francisco. Why aren't we filling the Potable AWSS from there? Doesn't the AWSS use Bay Water?

The primary water source for the existing AWSS is the 10 million gallon Twin Peaks Reservoir, 0.5 million gallon Ashbury Heights Tank, and 0.75 million gallon Jones Street Tank. As part of the AWSS bond-funded projects, the Summit Reservoir, with its 11 million gallons of storage, can now be better used by the AWSS. This reservoir serves as a back-up, and would only be utilized by the AWSS during a large fire.

If additional water sources are needed, there are 2 seawater pump stations on the east side of San Francisco that can be utilized to supply a back-up water supply to the AWSS. There have been no known uses of these 2 stations during a fire since their installation in the early 1900s.

The Sunset Reservoir North Basin, with its large capacity and seismic reliability, provides an excellent, existing supply that can be used for the proposed Potable AWSS at no additional cost to rate payers. This reservoir is nine times larger than the existing Twin Peaks reservoir, the primary source utilized by the AWSS.

In the future, an existing SFPUC pump station at Lake Merced will be modified to pump Lake Merced water into new AWSS pipelines that will be installed by the Park Merced development project. Eventually, the Park Merced AWSS pipeline could be connected to the existing AWSS pipeline near Ocean Avenue. Current work will connect the 140 million gallon University Mound Reservoir to the existing AWSS.

The SFPUC is also analyzing new seawater pump stations that could be developed along Ocean Beach and by Hunters Point Shipyard, and will provide updates to the public as the analysis is completed. These future pump stations could serve as back-up supplies for the AWSS and Potable AWSS. Please note that the Potable AWSS would have to be converted to an AWSS if seawater was used, which would cause the system to lose the benefit of being a seismically reliable potable water distribution system for the Sunset and Richmond Districts.

15) How long will it take to install the Potable AWSS in the Sunset and Richmond District? I want fire-suppression in the Westside of San Francisco ASAP.

The Potable AWSS is in the planning phase. Pipeline construction could begin in 2019 if the Management Oversite Committee gives direction to proceed with this project. SFPUC is requesting approval for funding of one mile of pipeline per year at $10 million per mile. Depending on the final length of Potable AWSS pipeline, the construction could be completed in four to eight years. A four-mile pipeline would take four years, while an eight-mile pipeline would take eight years. Each mile of pipeline installed provides significantly greater firefighting protection.

Please note that because the Potable AWSS option provides potable water benefits to the Sunset and Richmond Districts, bond funding **and** SFPUC rate payer funds could be used to pay for its implementation.

The same is not true if a traditional AWSS is deployed in the Sunset and Richmond Districts. Traditional AWSS systems can only utilize bond funding. Due to this distinction, a traditional AWSS would likely have a longer implementation timeline than a Potable AWSS because there is not enough bond funding in place to complete a traditional AWSS at this time. A Potable AWSS project could begin implementation more quickly using SFPUC rate payer funds.

16) How do population growth and new buildings affect firefighting reliability, and will AWSS be expanded to growing areas of San Francisco, such as new development areas in the east and southeast areas of San Francisco?

As new developments and population growth occur in San Francisco, the water required for firefighting to address post-earthquake fires may change. SFPUC is modelling the effects of new developments on AWSS capacity requirements, both within the new developments and in the City as a whole. The SFPUC and SFFD are working together to specify new AWSS piping and hydrants required within the new developments. Additionally, developers are required to contribute financing towards, or construct, AWSS facilities such as pipelines or pump stations, for additional firefighting needs. These requirements are specified in the Development Agreements approved by the Board of Supervisors for new, large development projects.

Appendix O

Project Name	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract
Cisterns	0	0	0	0	0	0	0	0	30	30	
Physical Plant	3	0	0	2	0	0	0	1	4	10	
Ashbury Tank									1		
Jones Street Tank									1		
Lake Merced Pumping Station - conventional AWSS	1										
Lake Merced Pumping Station - potable AWSS	1										
Pumping Station 1				1							
Pumping Station 2				1							
Twin Peaks Reservoir									1		
Twin Peaks Reservoir Joint Sealing									1		
Sunset Reservoir Pumping Station - potable AWSS	1										
University Mound Pumping Station - conventional AWSS								1			
Pipelines & Tunnels	1	2	2	3	0	0	5	6	9	28	
4th Street Connection							1				
Clarendon Supply			1								
Control System									1		
Fillmore & Haight								1			✓
Fort Mason Pier 2 Seawater Manifold								1			
Jones Street Tank Valves									1		
Pipeline Repairs									1		
Planning Study (CS-199)									1		
Pumping Station 1 Tunnel								1			
Seawater Fireboat Manifolds Evaluation									1		
Seawater Suction Connections									1		
Street Valve Motorization								1			
Twin Peaks Reservoir 16" Supply									1		
19th Avenue Pipeline			1								✓
Ashbury Bypass Pipeline				1							✓
Candlestick Point - Carroll Avenue									1		
Columbus & Green Pipeline									1		✓
FWSS - Lake Merced							1				
FWSS - McLaren Park Tanks							1				
FWSS - Street Crossings							1				
FWSS - Sunset Reservoir							1				
Ingleside Pipeline								1			
Irving Street Pipeline				1							✓
Lake Merced Pipeline		1									
Mariposa TFB Pipeline				1							
TFB Mission Rock - South Pipeline		1									
Westside Potable AWSS Pipeline	1										
University Mound East Pipeline								1			
Assessments	0	0	0	0	0	0	0	0	12	12	
Ashbury Heights Valve House Evaluation									1		
Jones Street Tank Generator Foundation Evaluation									1		
Jones Street Tank Retaining Walls Assessment									1		
Jones Street Tank Valve House Evaluation									1		
ESER 2014 Project Recommendations									1		
Pipeline Network Surge Analysis									1		
Pumping Station 1 Foundation & Well Evaluation									1		
Pumping Station 1 Tunnel Evaluation (PS1 to bay)									1		
Pumping Station 2 Discharge Tunnels Evaluation									1		
Pumping Station 2 Well Evaluation									1		
Twin Peaks Reservoir Forebays Evaluation									1		
Twin Peaks Reservoir Tunnel Evaluation									1		
	4	2	2	5	0	0	5	7	55	80	

	Planning	Design	Procurement or Bid/Award	Construction	Substantial Completion	Final Completion	Cancelled	Postponed	Complete	Total	SFPW Construction Contract

Appendix P

Candidate EFWS Projects

5/8/2019

Projects	Project Cost ($M) (2018 $)	No. of FRA's Directly Benefited	Hydraulic Power (MW)	Project Cost/MW ($M)	Scaling Factor to Lowest $/MW
Pipeline Projects					
1 Conv. AWSS PL - Diamond Street	4	1	0.7	6	1.0
2 Westside Seawater Supply PL	TBD				
3 Conv. AWSS PL - Lake Merced	4	1	0.1	25	4.2
4 Conv. AWSS PL - College Hill Supply	34	0	0.8	43	7.1
5 PEFWS	195	8	4.1	44	7.3
6 Conv. AWSS PL - Ingleside (Phase 1)	6	1	0.1	53	8.8
7 Conv. AWSS PL - Stanford Heights Supply	18	0	0.3	60	10.1
8 Conv. AWSS PL - University Mound East	23	4	0.4	67	11.2
9 Conv. AWSS PL - Ingleside (Phase 2)	14	1	0.2	78	13.0
10 Conv. AWSS PL - University Mound West	19	2	0.2	112	18.7
Subtotal Pipeline Projects	**317**		**6.8**		
Supply Projects					
1 Potable EFWS - Lake Merced PS	40	8	4.6	9	1.3
2 Conv. AWSS Lake Merced PS	10	2	1.5	7	1.0
3 Potable EFWS - Sunset PS	34	8	4.6	7	1.1
4 Conv. AWSS University Mound PS	20	10	2.6	8	1.2
5 Conv. AWSS Manifold - Pier 33-1/2	5	0	0.4	13	1.9
6 PS1 Well	2	0	0.1	13	2.1
7 Westside Seawater PS	TBD				
8 Conv. AWSS Manifold - Fort Mason Pier 1	8	0	0.4	21	3.1
9 Conv. AWSS College Hill Supply PS	25	0	1.0	25	3.8
10 Twin Peaks Forebays	6	0	0.2	26	3.9
11 Twin Peaks Tunnel	8	0	0.2	34	5.2
12 PS1 Tunnel (Phases 1 and 2)	13	0	0.3	43	6.6
13 Conv. AWSS Stanford Heights Supply PS	26	0	0.6	43	6.6
14 PS2 Discharge Tunnels	5	0	0.1	67	10.3
15 PS2 Well	4	0	0.04	89	13.7
Subtotal Supply Projects	**206**		**16.8**		
Infirm Zone Projects					
1 Conv. AWSS PLs - Infirm Zone 7	16	1	0.21	79	1.0
2 Conv. AWSS PLs - Infirm Zone 9	10	1	0.03	320	4.1
3 Conv. AWSS PLs - Infirm Zone 3, 4, 5	33	3	0.05	666	8.5
4 Conv. AWSS PLs - Infirm Zone 1, 2	32	2	0.04	790	10.1
5 Conv. AWSS PLs - Infirm Zone 6	18	1	0.00		
6 Conv. AWSS PLs - Infirm Zone 8	7	1	0.00		
7 Conv. AWSS PLs - Infirm Zone 10	19	1	0.00		
Subtotal Infirm Zone Projects	**135**		**0.3**		
Other Projects					
1 Conv. AWSS PL - PIPE - Bryant & 11th	16	0	0.15	104	1
2 Conv. AWSS PL - PIPE - Dolores & 20th	9	0	0.05	197	1.9
3 Conv. AWSS PL - PIPE - Brannan St.	36	0	0.04	953	9.2
4 Conv. AWSS PL - PIPE - Market St.	28	0	0.03	871	8.4
5 Ashbury Valve House	5	0			
6 Jones St Generator Foundation	1	0			
7 Jones St Valve House	5	0			
8 PS2 Remote Operation and Engine Repl.	12	0			
9 Miscellaneous Repairs	15	0			
10 Conv. AWSS PL - Surge Protection	4	0			
11 Conv. AWSS PL - Valve Renovation	6	0			
Subtotal Other Projects	**136**		**0.3**		
Development Projects					
1 Potrero PL	14	1			
2 Southern Area Supply Projects	166	5			
Subtotal Development Projects	**180**				
Grand Total	**974**		**19**		

1) MW=Hydraulic power (MW)
(1 MW = 1,341 hp)
2) S=Scaling factor to lowest $/MW

Appendix Q

Fire Dept.'s Ace in the Hole

By Jim Castleberry

The night of the Oct. 17 earthquake was not the first time the San Francisco Fire Department had to call on its Portable Water Supply System, but it was by far the most important.

When firefighters responded to a blaze in the Marina District, they were horrified to learn that *all the water lines in a 40 square block area surrounding the fire were broken and useless.*

With no water pressure, firefighters could only watch as the fire raged out of control and threatened to explode into the largest blaze in the city since 1906.

But the city had one more card to play – its ace in the hole.

Division Chief Harry Brophy issued the call for the Fireboat Phoenix and the department's Portable Water Supply System (PWSS).

For Assistant Chief Frank Blackburn, who developed the PWSS, and his fellow firefighters, it was the test they had been waiting for. The one that would determine once and for all if the PWSS, hailed as ingenious by some and a boondoggle by others, really worked. "I told the guys that this was the Super Bowl," Blackburn said.

Fortunately for the city, the PWSS performed perfectly.

As the Phoenix pumped water from the Bay, firefighters set up portable hydrants on Divisadero Street that allowed them to stretch hoses all the way to the fire at Beach Street.

Within an hour after the system was hooked up, the fire had been brought under control.

San Francisco's Board of Supervisors rewarded Blackburn with a commendation, thanking him not only for the development of the system but his quick work in putting it to use on Oct. 17.

"Without those portable hydrants, along with the fireboat, the city probably would have burned to the ground," Supervisor Terrance Hallinan said. "Blackburn knew where all the hydrants were and as soon as it hit, he rounded them up and set them into operation. It was a key to turning that whole situation around."

The key to the PWSS is the portable hydrant designed by Blackburn from old Gleeson pressure-reducing valves and other spare parts lying around the department's repair shop.

Using the hydrants, firefighters can pump from the Bay, a lake or underground cistern and lay a grid of hose covering several blocks.

The portable hydrants not only allow water pressure to be maintained, they also let firefighters hook up pumper trucks or fire hoses along the line so fires in multiple locations can be battled.

"Say there was a fire on Van Ness Avenue and all the water mains were broken," Blackburn said. "The PWSS would let you pump water from the Bay, all the way up Van Ness. People say it can't work, but it does. We proved it on Oct. 17."

Blackburn didn't start working on the portable hydrants and PWSS until 1984. By 1985 a prototype was ready and they were in regular use by 1986.

The PWSS helped put out a five alarm fire at First and Townsend street in 1987 and was also used at Hetch Hetchy later that year to protect buildings threatened by a fire burning in Yosemite National Forest.

"We drafted water from the Tuolumne River for that one," Blackburn said. "It's amazing. All you need is a body of water."

"It's something that San Francisco should really be proud of," said Dr. Charles Scawthorn, a researcher who has done extensive study of the risk posed to San Francisco by fire.

In 1987 Scawthorn wrote a report for the insurance industry on the conflagration risk in San Francisco following a major earthquake similar to 1906.

His report foresees widespread destruction with billions of dollars in property losses and dozens of major fires – similar in size to the Marina fire – after a magnitude 8.3 or larger quake.

"Everything that happened on Oct. 17 confirmed my findings," he said. "But the PWSS is obviously going to greatly improve the chance of the city surviving 'The Big One.' It won't save it entirely but at least we'll be able to limit the losses."

The Portable Water Supply System includes:

-- Four hose wagons that carry 4,000 to 5,000 feet of large, five inch diameter hose that connect to the portable hydrants (normal firehose is only three inches in diameter.

-- Underground cisterns located throughout the northern and eastern sections of the city that can be filled with water to supply trucks along the way.

-- Portable hydrants that allow water to flow freely for long distances at a very high pressure.

Scawthorn recommends a large-scale expansion of the PWSS.

"If there are only four hose wagons, you can only fight fires in four locations," Scawthorn said. "After a big quake there will be fires breaking out all over the city."

The Fire Commission has indicated its desire to expand the system and cleared the way for building of more cisterns in the outer Sunset and Richmond residential neighborhoods.

Plans are also underway to purchase more large-diameter hose, if the money can be found.

Blackburn calls it the best defense a city like San Francisco can have against fire following an earthquake.

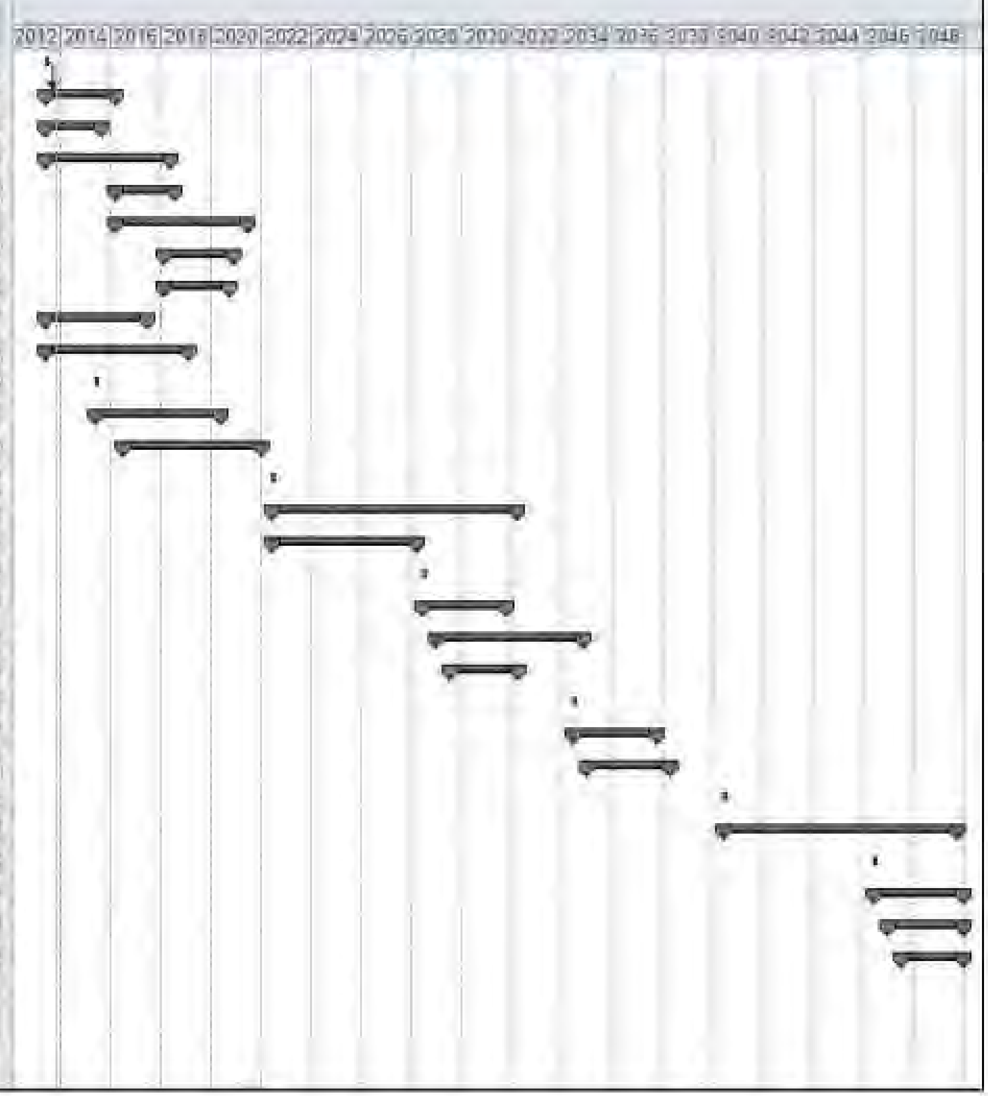
"When a major quake occurs and water mains are broken, the answer is the PWSS," he said. If you don't have it, you won't put the fires out."

1990 article on the Portable Water Supply System, an adjunct to the AWSS, and its use during the post-earthquake fires in October 1989.

Appendix R

Figure 5-1. Preferred Alternative Planning Level Schedule

	Task Name	Duration	Start	Finish
1	Alternative B	1 day	Mon 6/3/13	Mon 6/3/13
2	+ **Motorization & addition of seism**	**720 days**	**Tue 6/4/13**	**Mon 3/7/16**
6	+ **4th Street Hose**	**575 days**	**Tue 6/4/13**	**Tue 8/18/15**
10	+ **PS1 Tunnel upgrade**	**1296 days**	**Tue 6/4/13**	**Tue 5/22/18**
14	+ **Jones St. Tank Bypass Valves**	**624 days**	**Tue 3/8/16**	**Fri 7/27/18**
18	+ **Repair suction connections**	**1372 days**	**Tue 3/8/16**	**Wed 6/9/21**
22	+ **SCADA improvements**	**720 days**	**Fri 2/16/18**	**Thu 11/19/20**
26	+ **FB Manifold R&R**	**672 days**	**Fri 2/16/18**	**Mon 9/14/20**
30	+ **Pipe Investigation and Repair**	**1050 days**	**Tue 6/4/13**	**Mon 6/12/17**
34	+ **Sutro Connection and PS**	**1488 days**	**Tue 6/4/13**	**Thu 2/14/19**
38	2014 Bond	1 day?	Mon 6/1/15	Mon 6/1/15
39	+ **Reliability Upgrades at Facilities**	**1256 days**	**Tue 6/2/15**	**Tue 5/19/20**
43	+ **Cistern Construct 46 New Cister**	**1432 days**	**Fri 7/8/16**	**Mon 1/3/22**
47	2021 Bond	1 day?	Wed 6/1/22	Wed 6/1/22
48	+ **Pipeline Replacement Program**	**2548 days**	**Thu 6/2/22**	**Mon 3/8/32**
52	+ **Silver Extension**	**1808 days**	**Thu 6/2/22**	**Mon 3/13/28**
56	2027 Bond	1 day?	Thu 6/1/28	Thu 6/1/28
57	+ **University Mound Connection an**	**864 days**	**Fri 6/2/28**	**Wed 9/24/31**
61	+ **Sunset Extension**	**1528 days**	**Thu 12/21/28**	**Mon 10/30/34**
65	+ **Sunset Rezoning**	**708 days**	**Wed 7/11/29**	**Fri 3/26/32**
69	2033 Bond	1 day?	Thu 6/1/34	Thu 6/1/34
70	+ **Lake Merced Pump Station**	**864 days**	**Fri 6/2/34**	**Wed 9/23/37**
74	+ **Sunset Connection and PS**	**864 days**	**Thu 12/21/34**	**Tue 4/13/38**
78	2039 Bond	1 day?	Fri 6/1/40	Fri 6/1/40
79	+ **Pipeline Replacement Program**	**2432 days**	**Mon 6/4/40**	**Tue 9/28/49**
83	2045 Bond	1 day?	Fri 6/1/46	Fri 6/1/46
84	+ **Richmond Extension**	**935 days**	**Mon 6/4/46**	**Fri 12/31/49**
88	+ **Alemany Extension**	**791 days**	**Fri 12/21/46**	**Fri 12/31/49**
92	+ **Geneva Extension**	**647 days**	**Thu 7/11/47**	**Fri 12/31/49**



CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Brian Strong
Chief Resilience Officer
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mr. Strong,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

400 McAllister Street, Room 008, San Francisco, CA 94102-4512 • (415) 551-3635 • http://civilgrandjury.sfgov.org/

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Naomi M. Kelly
City Administrator
Office of the City Administrator
City Hall, Room 362
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Angela Calvillo
Clerk of the San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Ms. Calvillo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

July 15, 2019

Sandra Lee Fewer
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Fewer,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Catherine Stefani
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Stefani,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Aaron Peskin
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Peskin,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Gordon Mar
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mar,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Vallie Brown
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Brown,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Matt Haney
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Haney,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

July 15, 2019

Norman Yee
President
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear President Yee,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Rafael Mandelman
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Mandelman,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

City and County of San Francisco
2018 - 2019 Civil Grand Jury

July 15, 2019

Hillary Ronen
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Ronen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Shamann Walton
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Walton,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ahsha Safai
Supervisor
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Supervisor Safai,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than October 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Budget and Legislative Analyst
San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Sir or Madam,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Debbie Raphael
Director
San Francisco Department of the Environment
1455 Market Street, Suite 1200
San Francisco, CA 94103

Dear Ms. Raphael,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

July 15, 2019

Jeanine Nicholson
Fire Chief
San Francisco Fire Department
698 Second Street
San Francisco, CA 94107

Dear Chief Nicholson,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Stephen Nakajo
President
San Francisco Fire Commission
1765 Sutter Street
San Francisco, CA 94115

Dear President Nakajo,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

The Honorable London Breed
Mayor of San Francisco
City Hall, Room 200
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102

Dear Mayor Breed,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Harlan L. Kelly, Jr.
General Manager
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear General Manager Kelly,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson

CITY AND COUNTY OF SAN FRANCISCO
2018 - 2019 CIVIL GRAND JURY

July 15, 2019

Ann Moller Caen
President
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

Dear President Caen,

The 2018-2019 Civil Grand Jury will release a report entitled, *"Act Now Before It Is Too Late: Aggressively Expand and Enhance Our High-Pressure Emergency Firefighting Water System"* to the public on Wednesday, July 17, 2019. Enclosed is an advanced copy. By order of the Presiding Judge of the Superior Court, Hon. Garrett L. Wong, this report is to be kept confidential until the date of release.

California Penal Code §933(c) requires a response to be submitted to the Presiding Judge no later than September 15, 2019.

California Penal Code §933.05 states that as to each finding, the response must indicate one of the following:

1. The respondent agrees with the finding; or
2. The respondent disagrees with the finding, wholly or partially, with an explanation.

As to each recommendation, the response must indicate one of the following:

1. The recommendation has been implemented, with a summary of the implementation;
2. The recommendation has not yet been, but will be implemented in the future, with a timeframe for implementation;
3. The recommendation requires further analysis, with an explanation, scope, and parameters of that analysis, and a timeframe for discussion not more than six months from the publication of the grand jury report; or
4. The recommendation will not be implemented because it is not warranted or reasonable, with an explanation.

Please e-mail your response to Presiding Judge Wong at CGrandJury@sftc.org or mail to 400 McAllister Street, Room 008, San Francisco, CA 94102-4512.

Respectfully,

Rasha Harvey, Foreperson