2020
URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

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Prepared by:

The San Francisco
Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

Note: Primary table numbers and titles are specific to the body of this 2020 UWMP. Secondary table numbers and titles that are shown in brackets (e.g., [Standardized Table 3-1 Retail: Population – Current and Projected]) indicate the corresponding standardized table that is required to be submitted to DWR in a prescribed format. Standardized tables are provided in Appendix B, and SB X7-7 Verification Form tables are provided in Appendix D.

ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AF	acre-feet (volume of water, equivalent to 325,851 gallons)
Act	California Urban Water Management Planning Act
ACWD	Alameda County Water District
AWWA	American Water Works Association
AMI	advanced metering infrastructure
BACWA	Bay Area Clean Water Agencies
BAIRWMP	Bay Area Integrated Regional Water Management Plan
BARR	Bay Area Regional Reliability
BAWSCA	Bay Area Water Supply and Conservation Agency
BDPL	Bay Division Pipeline
BG	billion gallons
BMP	Best Management Practice
CalWEP	California Water Efficiency Partnership
Castlewood CSA	Castlewood County Service Area
CCF	hundred cubic feet (volume of water, equivalent to 748 gallons)
CCWD	Contra Costa Water District
CEQA	California Environmental Quality Act
cfs	cubic feet per second (flow rate of water)
CII	commercial, industrial, and institutional
Cordilleras MWC	Cordilleras Mutual Water Company
City	City and County of San Francisco
CUWA	California Urban Water Agencies
CUWCC	California Urban Water Conservation Council
CWC	California Water Code
DMMs	demand management measures
DPR	direct potable reuse
DRA	drought risk assessment
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
EOP	Emergency Operations Plan
ERRP	Emergency Response and Recovery Plan
FERC	Federal Energy Regulatory Commission
FY	fiscal year
GPCD	gallons per capita per day
gpm	gallons per minute

Groveland CSD	Groveland Community Services District
GSR	Groundwater Storage and Recovery
HET	high-efficiency toilet
HHLSM	Hetch Hetchy and Local Simulation Model
HTWTP	Harry Tracy Water Treatment Plant
IRWM	Integrated Regional Water Management
ISG	Individual Supply Guarantee
JPA	Joint Powers Authority
LCSD	Lower Crystal Springs Dam
LOS	Level of Service
LVE	Los Vaqueros Reservoir Expansion
MG	million gallons
mgd	million gallons per day (flow or usage rate of water)
MID	Modesto Irrigation District
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
MW	megawatt
NSMCSD	North San Mateo County Sanitation District, a subsidiary of the City of Daly City
PEIR	Programmatic Environmental Impact Report
PREP	Potable Reuse Exploratory Plan
RWS	San Francisco Regional Water System
RWSAP	Retail Water Shortage Allocation Plan
SB	Senate Bill
SB X7-7	Senate Bill Seven of the Senate’s Seventh Extraordinary Session of 2009 (a.k.a., Water Conservation Act of 2009)
SCVWD	Santa Clara Valley Water District
SFDBI	San Francisco Department of Building Inspection
SFDPH	San Francisco Department of Public Health
SFDPH-EH	San Francisco Department of Public Health-Environmental Health
SFPUC	San Francisco Public Utilities Commission
SFUSD	San Francisco Unified School District
SFO	San Francisco International Airport
State	State of California
SVCW	Silicon Valley Clean Water
SVWTP	Sunol Valley Water Treatment Plant
SWAP	Shared Water Access Program
SWRCB	State Water Resources Control Board
SWRCB DDW	SWRCB Division of Drinking Water, formerly the California Department of Public Health Drinking Water Program
TID	Turlock Irrigation District

U.S.	United States
USD	Union Sanitary District
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
UWMP	Urban Water Management Plan
WPCP	water pollution control plant
WQC	Clean Water Act section 401 Water Quality Certification for the Turlock Irrigation District and Modesto Irrigation District Don Pedro Hydroelectric Project and La Grange Hydroelectric Project
WSA	2009 Water Supply Agreement between SFPUC and its Wholesale Customers
WSAP	Water Shortage Allocation Plan
WSCP	Water Shortage Contingency Plan
WSIP	Water System Improvement Program
WTP	water treatment plant
WUEdata	DWR Water Use Efficiency data online submittal tool
Zone 7	Zone 7 Water Agency

SECTION 1: INTRODUCTION AND OVERVIEW

The San Francisco Public Utilities Commission (SFPUC) is pleased to present this 2020 update to the Urban Water Management Plan (UWMP) for the City and County of San Francisco (City).

The City owns and operates the San Francisco Regional Water System (RWS), a public asset that plays a key role in delivering high-quality drinking water to more than 2.7 million residents and businesses in the San Francisco Bay Area. The system collects water from the Tuolumne River in the Sierra Nevada and from protected local watersheds in the East Bay and Peninsula.

With the RWS, the SFPUC delivers water to 28 wholesale customers in Alameda, Santa Clara, and San Mateo Counties, as well as the Groveland Community Services District (Groveland CSD) in Tuolumne County and Cordilleras Mutual Water Company (MWC) in Redwood City. The Bay Area Water Supply and Conservation Agency (BAWSCA) represents the interests of 26 of the wholesale customers (not including Cordilleras MWC and Groveland CSD), generally referred to collectively as the Wholesale Customers, and coordinates their water conservation programming. The SFPUC also provides retail water service to customers in San Francisco (generally referred to as in-City retail customers) and a number of customers outside of San Francisco that are located along the RWS transmission system (generally referred to as suburban retail customers). Additionally, some retail customers are supplied with local groundwater and recycled water supplies.

This 2020 UWMP update presents the latest information on the SFPUC's retail and wholesale service areas; the RWS and other water systems operated by the SFPUC; system supplies and demands; water supply reliability; Water Conservation Act of 2009 compliance; and demand management. In addition, this update includes the SFPUC's current (Fiscal Year 2019-20) and projected demands and supplies for its retail and wholesale customers over the next 25 years. Retail demand projections have been updated to reflect population and employment growth, socioeconomic factors, and the latest conservation forecasts. This 2020 UWMP update coincides with additional planning efforts conducted by the SFPUC, including its 2020 Retail Water Conservation Plan update. When the UWMP was last updated in 2015, the State of California (State) was in the fourth year of a severe drought. During the drought, the unprecedented dry weather conditions prompted the implementation of Statewide conservation mandates; the SFPUC's customers met the call and continue to be among the lowest water consumers in the State. Consumption reached a historic low in 2015 and has remained low since. The SFPUC remains committed to comprehensive water efficiency efforts that will help sustain a continued reduction in water use.

In December 2018, the State Water Resources Control Board (SWRCB) adopted amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) to establish water quality objectives with the stated goal of increasing salmonid populations in three San Joaquin River tributaries (the Stanislaus, Merced, and Tuolumne Rivers) and the Bay-Delta. It remains unclear how or if the Bay-Delta Plan Amendment will be implemented. In acknowledgment of the uncertainty of whether and when the Bay-Delta Plan Amendment will come into effect, this UWMP presents future supply scenarios both with and without it. The two scenarios provided are intended to bookend the potential future supply conditions for the RWS. If the Bay-Delta Plan Amendment is implemented, the SFPUC will be able to meet the projected water use demands presented in this UWMP in normal years but would experience significant supply shortages in single dry years and multiple dry years. Without the implementation of the Bay-Delta Plan Amendment, the SFPUC will not experience shortages until the 4th and 5th year of a multi-year drought at 2045 levels of projected demand.

The SFPUC has initiated an Alternative Water Supply Planning Program to ensure that San Francisco can meet its retail and Wholesale Customer water needs, address projected dry year shortages, and limit rationing to a maximum of 20 percent system-wide in accordance with adopted SFPUC policies. This program is in early planning stages and is intended to meet future water supply challenges and vulnerabilities such as environmental flow needs and other regulatory changes; earthquakes, disasters, and emergencies; increases in population and employment; and climate change. As the region faces future challenges – both known and unknown – the SFPUC is considering a suite of diverse non-traditional supplies and leveraging regional partnerships to meet retail and Wholesale Customer needs through 2045.

In 2020, water suppliers are also required by the State of California to develop and adopt a Water Shortage Contingency Plan (WSCP). The WSCP contained herein describes the SFPUC's approach to meeting six standard water shortage stages, ranging from 10% to greater than 50% shortages. The WSCP includes a description of the SFPUC's annual Water Supply and Demand Assessment whereby total system water storage is compared to demands to evaluate the likelihood of a shortage in the coming year. Should a shortage be identified, the WSCP identifies appropriate shortage response actions, such as voluntary and mandatory rationing. The WSCP also describes the SFPUC's extensive emergency preparedness and planned response in the event of catastrophic interruptions of water supplies.

SECTION 2: PLAN PREPARATION AND IMPLEMENTATION

This section summarizes the actions taken by the SFPUC to assure agency coordination and public participation throughout the development of this 2020 UWMP.

2.1 BASIS FOR PREPARING A PLAN

The SFPUC has prepared this 2020 UWMP for the City and County of San Francisco (City) in accordance with the requirements of the 1983 California Urban Water Management Planning Act (Act), California Water Code (CWC) Division 6, Part 2.6, Sections 10610 through 10656, as last amended in 2020. A copy of the Act is provided in Appendix A. The purpose of the Act is to assure that water suppliers plan for long-term reliability, conservation, and efficient use of California's water supplies to meet existing and future demands. The Act requires that planning projections extend at least 20 years beyond the year of the UWMP, i.e., through 2040 for the 2020 UWMP cycle. The planning horizon for the SFPUC's 2020 UWMP is 25 years, i.e., through 2045.

The Act requires all urban water suppliers to prepare an UWMP every five years. The 2020 UWMPs are due to the California Department of Water Resources (DWR) by July 1, 2021. As defined by CWC Section 10617, an urban water supplier is a supplier (either publicly or privately owned) that provides water for municipal purposes to more than 3,000 customers (either directly or indirectly) or that supplies more than 3,000 acre-feet (AF) of water annually. The SFPUC meets these criteria as both a retail and wholesale supplier of water.

The SFPUC has prepared this individual UWMP specifically for the City and is not participating in the preparation of a regional UWMP.

2.2 FISCAL OR CALENDAR YEAR AND UNITS OF MEASURE

The data provided throughout this 2020 UWMP and the accompanying standardized tables are reported on a fiscal year (FY) basis. The SFPUC operates on a fiscal year that starts on July 1 and ends on June 30. The "current" fiscal year reported in this 2020 UWMP corresponds to FY 2019-2020, which represents the period from July 1, 2019 through June 30, 2020. Similarly, the projected year of 2025 denotes FY 2024-2025; 2030 denotes FY 2029-2030; and so on. Best efforts are made to convert data that are originally collected on a calendar year basis to a fiscal year basis. However, in a few cases, fiscal year quantities are approximated based on calendar year quantities and are noted as such.

The SFPUC's water supply planning, contracts, and related documents primarily use units of million gallons per day (mgd) when quantifying volumes of water. However, the standardized tables prescribed by DWR only allow volumetric water data to be reported in units of acre-feet (AF), million gallons (MG), or hundred cubic feet (CCF) per year. Therefore, the SFPUC has reported volumetric water data in this 2020 UWMP's standardized tables in units of acre-feet (AF) rounded to the nearest 10 AF (see Appendix B). The corresponding data in the body of this 2020 UWMP, however, are reported in units of mgd unless otherwise noted. Although reported in different units of measure, the quantities in both sets of data are equal. This approach has been discussed with and accepted by DWR staff in 2015 and is being carried forward in the 2020 plan.

2.3 COORDINATION AND OUTREACH

2.3.1 Agency Coordination

2.3.1.1 Coordination with City Agencies

The SFPUC coordinated with City agencies in developing elements of this 2020 UWMP and the documents referenced herein. The SFPUC consulted with the San Francisco Planning Department in developing water demand projections based on the City's growth projections for housing and employment. City agencies were notified of the SFPUC's intent to prepare the 2020 UWMP. The notice included instructions for viewing the draft 2020 UWMP, as well as the date, time, and location of the public hearing on the draft 2020 UWMP. Comments received from these agencies on the proposed 2020 UWMP were reviewed and addressed, as appropriate. Documentation relating to these efforts and communications is provided in Appendix C.

2.3.1.2 Regional Interagency Coordination

The SFPUC coordinated the development of this 2020 UWMP with its wholesale customers and BAWSCA, a public agency representing 26 member agencies—24 cities and water districts, as well as two private utilities—in Alameda, Santa Clara, and San Mateo Counties that purchase water on a wholesale basis from the SFPUC. The SFPUC has individual water sales contracts with 27 wholesale customers, 26 of which are members of BAWSCA. Cordilleras Mutual Water Company (Cordilleras MWC) is a wholesale customer of the SFPUC but not a member of BAWSCA. Groveland Community Services District (Groveland CSD) is considered a retail customer by the SFPUC, but for the purposes of this 2020 UWMP, is recognized as a wholesale customer. Throughout this document, references to Wholesale Customers generally mean the 26 wholesale customers that are members of BAWSCA. For more information about the SFPUC's wholesale customers, see Section 3.3.

The SFPUC provided water supply reliability information for distribution to all BAWSCA members. Supplies were projected in five-year increments from 2020 through 2045 for normal, single dry, and multiple dry years. These projections are provided in Appendix C. The SFPUC also worked with all of its wholesale customers, either individually or through BAWSCA, to obtain population and water supply purchase projections in five-year increments through the year 2045. Wholesale customers that are urban water suppliers are concurrently preparing their own 2020 UWMPs; therefore, the data provided for use in the SFPUC's 2020 UWMP are subject to change.

In addition to coordinating with its wholesale customers, the SFPUC also communicated with other Bay Area water agencies, including the East Bay Municipal Utility District (EBMUD), Santa Clara Valley Water District (SCVWD), Contra Costa Water District (CCWD), and Zone 7 Water Agency (Zone 7); and counties in which the SFPUC provides water, which are the counties of San Francisco, San Mateo, Alameda, Santa Clara, San Joaquin, and Tuolumne.

All wholesale customers, Bay Area water agencies, and counties in which SFPUC provides water were notified of the SFPUC's intent to prepare the 2020 UWMP. The notice included instructions for viewing the draft 2020 UWMP, as well as the date, time, and location of the public hearing on the draft 2020 UWMP. Comments received from these agencies on the proposed 2020 UWMP were reviewed and addressed, as appropriate. Documentation relating to these efforts and communications is provided in Appendix C.

2.3.2 Public Participation

The SFPUC has always actively encouraged public participation in its urban water management planning efforts. Public outreach activities for the 2020 UWMP update are listed below. Further documentation is included in Appendix C. Notification of the 2020 UWMP update was electronically mailed on February 8, 2021, with an additional mailing on March 8, 2021, to all cities and counties within which the SFPUC provides water, as well as to other interested parties. The notification letter served as both (1) a notice to cities and counties about the 2020 UWMP update, and (2) a notice of the time and place of the corresponding public hearing, as required by the CWC. A list of notified organizations and individuals is provided in Appendix C.

The draft 2020 UWMP was made available for review prior starting on April 5th, 2021 at **www.sfpuc.org/uwmp**. The draft 2020 UWMP was made available for review by the public from April 5 to May 5, 2021. The SFPUC will meet with the Citizens Advisory Committee (CAC) and the CAC Water Subcommittee on April 20th, 2021 and April 27th, 2021, respectively, to present on the draft 2020 UWMP update. The Citizens Advisory Committee meeting is publicly noticed on the SFPUC website at **www.sfpuc.org**.

A public hearing will be held on April 13, 2021 during an SFPUC Commission meeting. A notice of the hearing was advertised in the local newspaper on March 29, 2021 and April 5, 2021 in accordance with California Government Code Section 6066. Copies of newspaper advertisements of the public hearing are provided in Appendix C. Public comments on the draft 2020 UWMP will be taken during the public hearing, as well as throughout the 30 day public comment period. An adoption hearing will be held at a subsequent SFPUC Commission meeting prior to the July 1, 2021 deadline for submittal to DWR. For 2020 UWMP adoption, submittal, and implementation, see Section 11.1.

2.4 ACCOUNTING FOR GROVELAND CSD

Groveland CSD, located in a semi-rural area of southern Tuolumne County, serves approximately 3,500 customers in Groveland, Big Oak Flat, and Pine Mountain Lake that are primarily residential and commercial water users. Prior to 2015, the SFPUC's UWMP had reported Groveland CSD as a retail customer since Groveland CSD had not prepared its own UWMP until 2010. The SFPUC also considers Groveland CSD a retail customer and accounts for it as such in its contractual obligations and supply planning. However, for the purposes of the 2015 UWMP update, DWR directed the SFPUC to report Groveland CSD as a wholesale customer. In order to accommodate both the SFPUC's planning needs and DWR's requirements, this 2020 UWMP accounts for Groveland CSD differently (either as a retail customer or a wholesale customer) depending on the context:

- For the purposes of describing the SFPUC's wholesale service area, population, demands, and supplies as directed by DWR, and to avoid potential double counting during regional or Statewide aggregation of UWMP data, Groveland CSD is considered a wholesale customer and reported as such in Section 3 of the body of this UWMP and the standardized tables in Appendix B.

- For the purposes of describing contractual obligations and RWS supply allocations between the SFPUC and its Wholesale Customers, Groveland CSD is considered a retail customer and is reported as such in the body of this 2020 UWMP, specifically Sections 4, 6, 7, and 8.

- For the purposes of calculating per capita baselines and targets in accordance with the Water Conservation Act of 2009, also known as Senate Bill (SB) X7-7, Groveland CSD is considered a wholesale customer. Therefore, Section 5 of the body of this 2020 UWMP and the corresponding SB X7-7 Verification Form tables in Appendix D do not include Groveland CSD.

The SFPUC obtained actual and projected population and demand data from Groveland CSD. As Groveland CSD is currently preparing its 2020 UWMP update, the data provided for use in the SFPUC's 2020 UWMP are subject to change.

Any discrepancies between corresponding tables in the body of this 2020 UWMP and Appendix B resulting from the difference in Groveland CSD accounting will be noted. This approach has been discussed with and deemed appropriate by DWR staff.

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SECTION 3: SYSTEM DESCRIPTION

This section describes the SFPUC's water system (including the RWS and in-City distribution system), retail and wholesale service areas, climate, and demographic features.

3.1 SFPUC WATER SYSTEM OVERVIEW

Over 2.7 million people in San Francisco and throughout the Bay Area rely on water supplied by the SFPUC to meet their daily water needs. The RWS is municipally-owned infrastructure operated by the SFPUC, a department of the City and County of San Francisco, and serves both retail and wholesale customers. The RWS supplies high-quality drinking water from the Tuolumne River watershed and from local reservoirs in the Alameda and Peninsula watersheds. The RWS draws an average of 85% of its supply from the Tuolumne River watershed, collected in Hetch Hetchy Reservoir in Yosemite National Park. This water feeds into an aqueduct system delivering water 167 miles by gravity to Bay Area reservoirs and customers. The remaining 15% of the RWS supply is drawn from local surface waters in the Alameda and Peninsula watersheds. The split between these resources varies from year to year depending on the water year hydrology and operational circumstances.

Separate from the RWS, the in-City distribution system is also owned and operated by the SFPUC and serves a population of nearly 900,000 in San Francisco. In-City retail customers are primarily served with RWS supply, but a few customers also receive groundwater and recycled water. Similarly, the SFPUC's suburban retail customers[1], outside of San Francisco, are primarily served with RWS supply, but a few customers also receive groundwater. The RWS, in-City distribution system, and other localized systems are described in the following sections.

3.1.1 Historical Development of the RWS

The RWS evolved through the development of two separate water systems: the Spring Valley Water Company system and the Hetch Hetchy Project. The Spring Valley Water Company was established in 1858 as it developed a spring and several creeks in San Francisco into a local water system. It expanded over the next few decades with the construction of the Pilarcitos, San Andreas, and Upper and Lower Crystal Springs Dams on the Peninsula. Further expansions included the development of the Pleasanton Well Field, the Sunol Filter Gallery, and Calaveras Dam in southern Alameda County.

Very early in San Francisco's development, it was recognized that the local water resources would be inadequate to support a burgeoning metropolis; thus, plans for importing water from the Sierra Nevada were born. In the late 1800s, the City's decision to develop its own water supply system culminated in the planning, financing, and construction of the Hetch Hetchy Project. Because many of the Hetch Hetchy Project facilities were to be located on public land within Yosemite National Park and Stanislaus National Forest, Congressional approval of the use of federal land was required. That approval was granted by the Raker Act of 1913 (38 Stat. 242). For more information about the Raker Act and the City's water rights under State law, see Section 3.1.4.

The construction of the Hetch Hetchy Project began in earnest in 1914. After almost 20 years of construction (including the building of Hetch Hetchy Reservoir and the 1930 acquisition of the Spring Valley Water Company by the City), Tuolumne River water began flowing into Upper Crystal Springs Reservoir in October 1934. Through the coordinated operation of the two systems, the SFPUC has been able to provide the residents of the City and its neighboring communities with a supply of high-quality potable water from high-quality sources.

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[1] Suburban retail customers are retail customers located outside of SFPUC's retail service area. More information on suburban retail customers is provided in section 3.1.5.2.

Since the 1930s, the major additions to the RWS have included the raising of O'Shaughnessy Dam and the development of Lake Lloyd (a.k.a., Cherry Lake); the construction of additional pipelines across the San Joaquin Valley; and the local construction of San Antonio Reservoir in Alameda County and Bay Division Pipelines (BDPL) Nos. 2, 3, and 4. Other local projects have included Crystal Springs Pipeline No. 3, Sunol Valley and San Andreas (now Harry Tracy) Water Treatment Plants, the Crystal Springs Bypass Tunnel and Balancing Reservoir, and the Tesla Treatment Facility.

3.1.2 Water Distribution

This section further describes how water is distributed by the RWS and the in-City distribution system.

3.1.2.1 Regional Water System

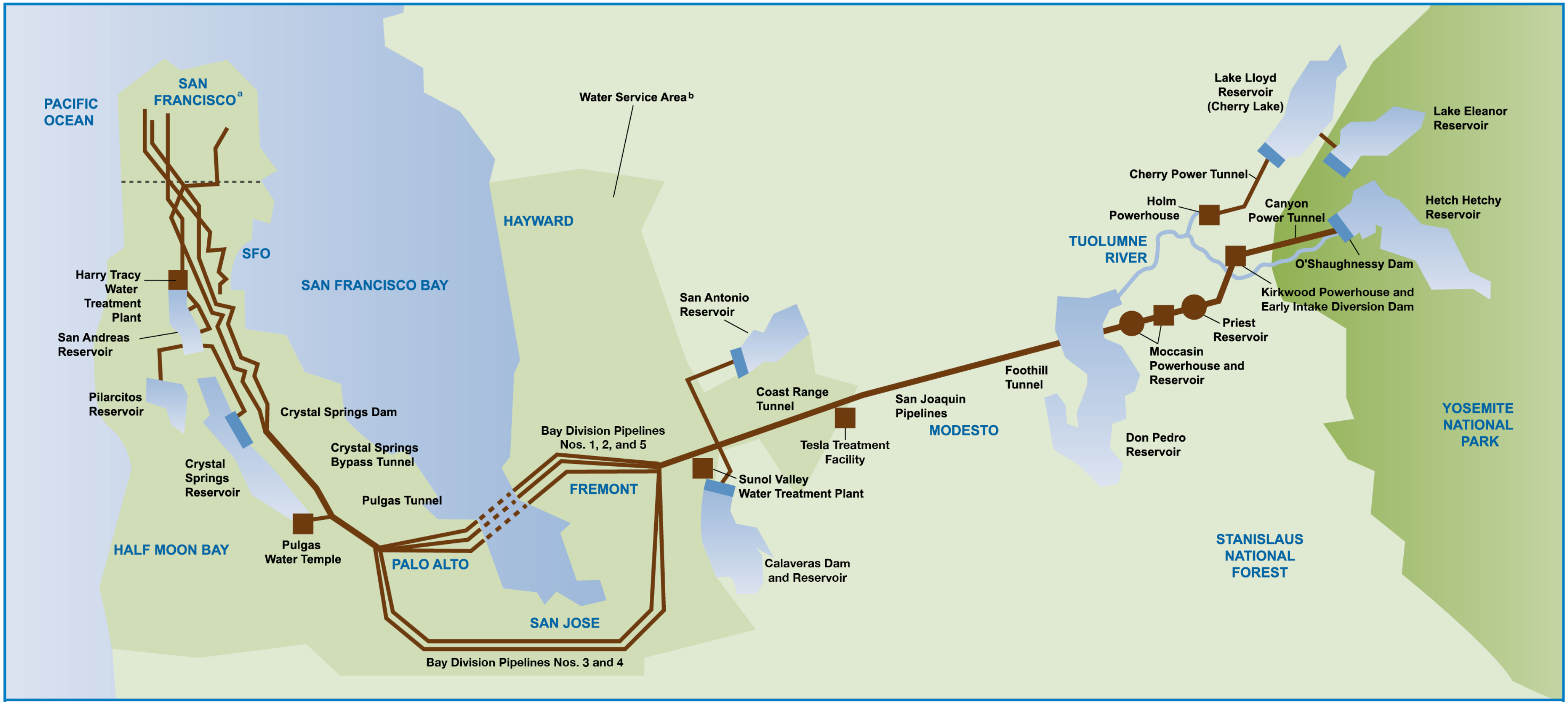
The RWS, shown in Figure 3-1, consists of more than 280 miles of pipelines, 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. It includes the Hetch Hetchy Project and the Bay Area water system facilities. The Hetch Hetchy Project is generally composed of the reservoirs, hydroelectric generation and transmission facilities, and water transmission facilities from the Hetch Hetchy Valley west to the Alameda East Portal of the Coast Range Tunnel in Sunol Valley. Water system components of the Hetch Hetchy Project are also referred to as the Hetch Hetchy System. The local Bay Area water system is comprised of two parts—the Alameda System and the Peninsula System—generally consisting of the facilities west of the Alameda East Portal of the Coast Range Tunnel, including the 63,000-acre Alameda and Peninsula watersheds, storage reservoirs, two water treatment plants, and the distribution system that delivers water to both retail and wholesale customers. The Hetch Hetchy, Alameda, and Peninsula Systems are described in more detail below.

- **Hetch Hetchy System:** In the Hetch Hetchy System, water is diverted from Hetch Hetchy Reservoir into a series of tunnels and aqueducts from the Sierra Nevada to the San Joaquin Pipelines that cross the San Joaquin Valley to the Coast Range Tunnel, which connects to the Alameda System at the Alameda East Portal. Hetch Hetchy System water is disinfected at the Tesla Treatment Facility.

- **Alameda System:** The Alameda System includes two reservoirs, San Antonio Reservoir and Calaveras Reservoir, which collect water from the San Antonio Creek, Upper Alameda Creek, and Arroyo Hondo watersheds in Alameda County. San Antonio Reservoir also receives water from the Hetch Hetchy System. Conveyance facilities in the Alameda System connect the Hetch Hetchy System and Alameda water sources to the Peninsula System. The BDPLs cross the South Bay to the Peninsula System delivering water to customers along the pipeline route. The Sunol Valley Water Treatment Plant (SVWTP) filters and disinfects water supplied from San Antonio Reservoir and Calaveras Reservoir.

- **Peninsula System:** The Peninsula System includes conveyance facilities connecting the BDPLs to the in-City distribution system and to other customers on the Peninsula. Two reservoirs, Crystal Springs Reservoir and San Andreas Reservoir, collect runoff from the San Mateo Creek watershed. Crystal Springs Reservoir also receives water from the Hetch Hetchy System. A third reservoir, Pilarcitos Reservoir, collects runoff from the Pilarcitos Creek watershed and directly serves one of the Wholesale Customers, the Coastside County Water District (which includes the City of Half Moon Bay), along with delivering water to Crystal Springs and San Andreas Reservoirs. The Harry Tracy Water Treatment Plant (HTWTP) filters and disinfects water supplied from Crystal Springs Reservoir and San Andreas Reservoir before it is delivered to customers on the Peninsula and the in-City distribution system.

Figure 3-1. Regional Water System



a Three pump stations on Treasure Island are not depicted.

b The water service area shown is approximate and for illustrative purposes only. For more accurate boundaries of the retail and wholesale service areas, see Figures 3-3 and 3-4, respectively.

3.1.2.2 In-City Distribution System

San Francisco's in-City distribution system (Public Water System No. CA3810011) was originally developed during the 100-year period between 1860 and 1960, reflecting the patterns and rates of growth in the City. Several major pipelines convey RWS supply from the Peninsula System to the City. Water to the eastside of the in-City distribution system is fed by two pipelines that terminate at University Mound Reservoir. Water to the westside of the in-City distribution is fed by two pipelines that terminate at Sunset Reservoir and one that terminates at Merced Manor Reservoir. As shown in Figure 3-1, the in-City distribution system also includes ten reservoirs and eight water tanks that store water supplied by the RWS. Seventeen pump stations[2] and approximately 1,250 miles of pipelines move water throughout the system and deliver water to homes and businesses in the City.

3.1.3 Water Treatment

The Hetch Hetchy Reservoir is the largest unfiltered water supply on the West Coast, and one of only a few large unfiltered municipal water supplies in the nation. The water originates from well-protected wilderness areas in Yosemite National Park, which flows down the Tuolumne River to Hetch Hetchy Reservoir. This water meets or exceeds all federal and State criteria for watershed protection. Water from Hetch Hetchy Reservoir is protected in pipes and tunnels as it is conveyed to the Bay Area, and requires pH adjustment to control pipeline corrosion and disinfection for bacteria control. Based on the SFPUC's disinfection treatment practice, extensive bacteriological quality monitoring, and high operational standards, the U.S. Environmental Protection Agency (USEPA) and the SWRCB Division of Drinking Water (DDW) determined that the Hetch Hetchy water source meets federal and State drinking water quality requirements without the need for filtration.

A new USEPA regulation took effect in 2012 requiring secondary disinfection for all unfiltered drinking water systems to control the waterborne parasite cryptosporidium. To comply with this regulation, the SFPUC completed construction of a new ultraviolet (UV) treatment facility in 2011. The Tesla Treatment Facility is a key component of the Water System Improvement Program (WSIP) and enhances the high-quality water from the RWS. The facility has a capacity of 315 mgd, making it the third largest UV drinking water disinfection facility in the U.S.

All water derived from sources other than Hetch Hetchy Reservoir is treated at one of two treatment plants: the SVWTP or the HTWTP. The SVWTP primarily treats water from the Alameda System reservoirs and has both a peak capacity and sustainable capacity of 160 mgd. Treatment processes include coagulation, flocculation, sedimentation, filtration, disinfection, fluoridation, corrosion control treatment, and chloramination. Fluoridation, chloramination, and corrosion control treatment can also be provided for the combined Hetch Hetchy System and SVWTP water at the Sunol Valley Chloramination Facility. The HTWTP treats water from the Peninsula System reservoirs and has a peak capacity of 180 mgd and a sustainable capacity of 140 mgd. Treatment processes include ozonation, coagulation, flocculation, filtration, disinfection, fluoridation, corrosion control treatment, and chloramination. Major upgrades to the SVWTP were completed in 2013 and to the HTWTP in 2015.

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[2] This number of pump stations does not include three pump stations on Treasure Island, which are not operated by the SFPUC.

Figure 3-2. In-City Distribution System

3.1.4 Water Storage

The majority of the water delivered by the SFPUC is supplied by runoff from the upper Tuolumne River watershed on the western slope of the central Sierra Nevada. Three major reservoirs collect runoff: Hetch Hetchy Reservoir, Lake Lloyd (a.k.a., Cherry Lake), and Lake Eleanor. The storage capacity of these three reservoirs is included in

Table 3-1. A “water bank” in Don Pedro Reservoir is also integrated into system operations.[3] Don Pedro Reservoir, which is jointly owned and operated by Modesto Irrigation District and Turlock Irrigation District (the Districts), is located on the Tuolumne River downstream of the Hetch Hetchy System.

As a by-product of water delivery and water supply management, hydroelectric power is generated by the Hetch Hetchy Water and Power System. Water stored in Hetch Hetchy Reservoir is used for hydroelectric generation and also satisfies instream flow requirements when released downstream. Normally, only Hetch Hetchy Reservoir water supplies are exported to the Bay Area, while releases from Lake Eleanor and Lake Lloyd are used to satisfy instream flow requirements, satisfy Raker Act entitlements to the Districts downstream, and produce hydroelectric power. The Hetch Hetchy Water and Power System includes three major hydroelectric powerhouses along the Tuolumne River—Holm, Kirkwood, and Moccasin—that have a collective generating capacity of nearly 400 megawatts.

Downstream of the Hetchy Hetchy System, the SFPUC utilizes local watersheds in the Bay Area. Crystal Springs, San Andreas, and Pilarcitos Reservoirs, located in San Mateo County, capture local runoff in the Peninsula watershed, and Calaveras and San Antonio Reservoirs, located in Alameda Country, capture local runoff in the Alameda watershed. In addition to capturing local runoff, San Andreas, San Antonio, and Crystal Springs Reservoirs also provide storage for water from the Hetch Hetchy System and, along with Calaveras Reservoir, are an important water supply in the event of an interruption to Hetch Hetchy System deliveries. The storage capacity of each of these Bay Area reservoirs is included in Table 3-1.

Calaveras Reservoir had been operating in recent years at one-third of its capacity due to restrictions imposed by the DWR Division of Safety of Dams (DSOD). The Calaveras Dam Replacement Project, which took place from 2011 to 2019, involved the construction of a new dam downstream of the existing dam. The SFPUC began impounding water behind the new dam in the winter of 2018/2019 and continued the initial fill of the reservoir during the 2019/2020 winter season.

The in-City reservoirs and tanks collectively have the capacity to hold approximately 413 MG of water. The SFPUC estimates this capacity to be a five-day supply at the current average water consumption rate for the City. In addition, there is an emergency supply of existing non-potable water immediately available within the City at Lake Merced. Lake Merced currently holds approximately 1.9 billion gallons of water.

Table 3-2 summarizes the storage capacity of in-City reservoirs and storage tanks, not including Lake Merced.

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[3] The Turlock Irrigation District and Modesto Irrigation District (Districts) have senior water rights to the City for the Tuolumne River water and are provided the first increment of flow in the Upper Tuolumne River watershed according to the apportionment set forth in the Raker Act of 1913 (38 Stat. 242). The water bank at Don Pedro Reservoir provides a credit and debit system, which allows the City to divert water upstream while meeting its obligations to the Districts. Through this mechanism, the SFPUC may pre-deliver the Districts’ entitlements and credit the water bank so that at other times the SFPUC may retain water upstream while the Districts debit the water bank.

Table 3-1. Regional Water System Storage Capacity

[Standardized Table: Not Applicable]

RWS Reservoir	Storage	
	Acre-Feet (AF)	Billions of Gallons (BG)
Up-Country[a]		
Hetch Hetchy	360,360	117.4
Lake Lloyd[b]	273,300	89.1
Lake Eleanor	27,100	8.8
Subtotal Up-Country	660,760	215.3
Local		
Calaveras (East Bay)[c]	96,800	31.5
San Antonio (East Bay)	50,500	16.5
Crystal Springs (Peninsula)[d]	69,300	22.6
San Andreas (Peninsula)	19,000	6.2
Pilarcitos (Peninsula)	3,100	1.0
Subtotal Local	238,700	77.8
Total RWS Storage[e]	899,460	293.1

a Three other regulating reservoirs are also part of the RWS: Early Intake, Priest, and Moccasin Reservoirs.

b Storage capacity shown includes flashboards, which are structures placed in a spillway to increase the capacity of a reservoir.

c Calaveras Reservoir was constructed with a storage capacity of 96,800 AF. Since December 2001, in response to safety concerns about the seismic stability of the dam and a directive from the Division of Safety of Dams (DSOD), the SFPUC held the maximum water level at approximately 37,800 AF (roughly 40% of its maximum capacity). The construction of a new replacement dam downstream was completed in 2019 to restore the dam's full storage capacity and the dam was continuing to be filled over the 2019/2020 winter season.

d Crystal Springs Reservoir has a maximum storage capacity of 22.6 BG (at 291.8 feet). Based on permit conditions, , the reservoir is currently operated at 287.8 feet (4 feet below capacity).

e This includes 63,700 AF in dead storage (i.e., the volume in a reservoir below the lowest controllable level). In addition, the SFPUC may draw against a credit of up to 570,000 AF in storage in a water bank account in Don Pedro Reservoir, for total storage for planning purposes of 1,469,460 AF.

Table 3-2. In-City Potable Water System Storage Capacity

[Standardized Table: Not Applicable]

In-City Reservoir	Storage	
	Acre-Feet (AF)	Millions of Gallons (MG)
Sunset	542	177
University Mound	432	141
Sutro	96	31
Summit	43	14
College Hill	41	13
Stanford Heights	40	13
Merced Manor	29	10
Lombard	8	3
Potrero	3	1
Hunters Point	3	1
Storage Tanks	29	9
Total In-City Storage	1,267[a]	413

a Rows above do not sum to total due to rounding.

3.1.5 Other Retail Water Systems

3.1.5.1 Groundwater and Recycled Water Systems

While the in-City distribution system is the primary system serving San Francisco retail customers, several customers also receive groundwater or recycled water. The San Francisco Recreation and Park Department (RPD) operates and maintains groundwater wells serving irrigation and other non-potable uses (e.g., lake filling, water exhibits) at Golden Gate Park, the San Francisco Zoo, and landscaped medians along the Great Highway. More information about this groundwater supply is provided in Section 6.2.1.1.

The City's golf courses at Harding Park (which includes Fleming Golf Course) and a portion of Sharp Park are provided recycled water for irrigation. Harding Park, an in-City retail customer, is served recycled water by the North San Mateo County Sanitation District (NSMCSD) in Daly City. Sharp Park, a suburban retail customer, is served recycled water by the North Coast County Water District (NCCWD) in Pacifica. The SFPUC neither owns nor operates either of these recycled water systems, except for a portion of the Harding Park recycled water transmission line that is within City limits, and an onsite 700,000-gallon underground storage tank and above-ground pump station at Harding Park. More information about these recycled water supplies is provided in Section 6.2.1.2.

3.1.5.2 Suburban Retail Water Systems

The SFPUC serves a number of retail customers outside the City. These customers are collectively referred to as suburban retail customers or customers in the suburban retail service area. These customers are generally located right off of RWS transmission pipelines and do not form one contiguous service area. More information about the suburban retail service area is provided in Section 3.2. However, there are two small water systems in unincorporated Alameda County that are operated by the SFPUC as permitted by the SWRCB DDW: the Castlewood Well System and the Town of Sunol domestic water system.

- **Castlewood Well System:** The SFPUC owns and operates the Pleasanton Well Field Water System[4] (Public Water System No. CA0110018; herein referred to as the Castlewood Well System), which in FY 2019-2020 supplied approximately 0.3 mgd of treated (potable) groundwater to the Castlewood County Service Area (CSA), a community comprised of the Castlewood Country Club and approximately 190 homes located in unincorporated Alameda County. The Castlewood community water system itself is owned and operated by the CSA and the California Water Service Company, respectively.

  The SFPUC serves the Castlewood CSA through one metered connection with groundwater pumped from the Castlewood Well System. This system consists of two wells, a 3,000-gallon control tank, and a 1.0-million gallon treated water reservoir. The supply is disinfected via sodium hypochlorite injection into the transmission main between the control tank and reservoir. Water quality is monitored weekly by the SFPUC.

- **Town of Sunol Domestic Water System:** The SFPUC owns and operates the domestic water system for the Town of Sunol (Public Water System No. CA0110012), which typically serves less than 0.1 mgd to approximately 120 metered and unmetered connections in unincorporated Alameda County. These connections are primarily residential customers and are supplied with potable water from the RWS. After RWS supply is fully treated, fluoridated, and chloraminated, the supply enters the Town of Sunol transmission pipeline downstream of Sunol Valley Mixing Manifold. The supply is then piped to a pump station at the SFPUC's Sunol Yard. The supply is pumped to two 130,000-gallon storage tanks. Water quality is overseen by the SFPUC.

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[4] The Castlewood wells are the last remnant of Spring Valley's Pleasanton well system, which were last used to export water to San Francisco for 15 months in 1948-49.

3.2 RETAIL SERVICE AREA

Retail customers include the residents, businesses, and industries located within City limits, referred to as the in-City retail service area. Retail service is also provided to a patchwork of customers located outside the City, such as the Town of Sunol, San Francisco International Airport (SFO), Lawrence Livermore National Laboratory, and Castlewood CSA. These areas are not contiguous and are collectively referred to as the suburban retail service area. Both the in-City and suburban retail service areas are shown **in** Figure 3-2.

3.2.1 Climate

The San Francisco Bay Area as a whole has a Mediterranean climate. In the City and its vicinity, summers are cool and winters are mild with infrequent rainfall. Temperatures average 57 degrees Fahrenheit annually, ranging from the mid-40s in the winter to the upper 60s in the late summer. Strong onshore flow of wind in the summer keeps the air cool, generating fog through September. The warmest temperatures generally occur in September and October. Rainfall averages about 22 inches per year and is generally confined to the “wet” season from late October to early May.[5] Except for occasional light drizzles from thick marine stratus clouds, summers are nearly dry.

For a discussion of climate change and potential impacts, see Section 6.1.3.

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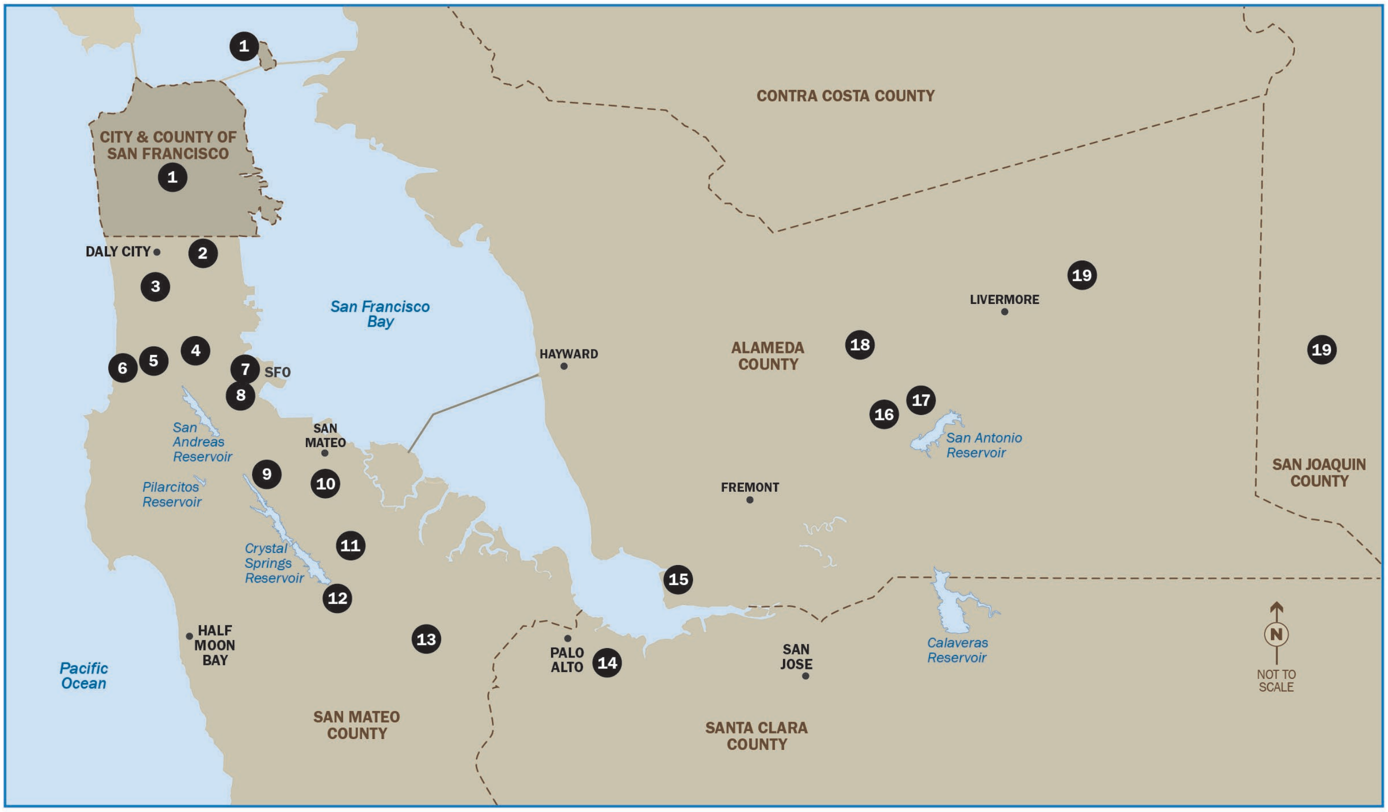
[5] Average maximum and minimum temperatures and average monthly rainfall data obtained from Western Regional Climate Center, 1981-2010 data from two San Francisco monitoring stations (Mission Dolores/SF#047772 and Richmond/SF#047767). Accessed from: **www.wrcc.dri.edu**.

Figure 3-3. Retail Service Area



In-City Retail Service Area

1 City and County of San Francisco

Suburban Retail Service Area

2 Residential and Non-residential Customers in Daly City
3 Cemeteries in Colma
4 Golden Gate National Cemetery
5 San Francisco County Jail #5
6 Sharp Park Golf Course
7 San Francisco International Airport
8 SFPUC Millbrae Headquarters
9 Crystal Springs Golf Course
10 Penninsula Golf and Country Club
11 Residential Customers in Redwood City
12 Filoli Center
13 Menlo Country Club
14 NASA Ames Research Center
15 Cargill Salt
16 Residential and Non-residential Customers in Sunol
17 GE Hitachi Nuclear
18 Castlewood Country Club
19 Lawrence Livermore National Laboratory (two sites)

The suburban customers shown above represent the majority of water use in the suburban retail service area, but are not comprehensive. For the purposes of the 2020 UWMP, Groveland Community Services District is considered a retail customer in the context of the Water Supply Agreement and allocating Regional Water System supplies between retail and Wholesale Customers. Groveland is shown in Figure 3-4.

3.2.2 Population and Demographics

As shown in Table 3-3 the total population in the retail service area is currently estimated to be 897,806 and is projected to increase to nearly 1.3 million by 2045. Retail population projections are provided here; however, when future retail water demands are forecast, they are based on actual demand from existing households and new demand from projected housing growth rather than projected population growth. See Section 4.1 for further discussion of retail demand forecasting.

Table 3-3. Retail Service Area Population

[Standardized Table 3-1 Retail: Population - Current and Projected]

Retail Service Area	Actual	Projected				
	2020	2025	2030	2035	2040	2045
In-City Retail[a]	897,806	1,002,873	1,064,477	1,126,081	1,187,684	1,249.288
Suburban Retail[b]	1,926	1,926	1,926	1,926	1,926	1,926
Total Retail	899,732	1,004,799	1,066,403	1,128,007	1,189,610	1,251,214

[a] County of San Francisco population for January 1, 2020 obtained from the California Department of Finance Report E-5, released April 1, 2020. County of San Francisco population projections obtained from the San Francisco Planning Department consistent with their Housing Element 2022 Update.

[b] Actual and projected population based on the number of retail residential service connections in Redwood City, Daly City, Fremont, and Millbrae; the number of homes in Castlewood CSA; inmate population of the San Francisco County Jail #5 in San Bruno; Department of Water Resources (DWR) Population Tool for Town of Sunol; and 2000 and 2010 U.S. Census data. Methodology used to estimate population in the suburban retail service area was approved through pre-review with DWR and is detailed in Section 5.1. Population for Groveland CSD is not included as retail, but reported as wholesale in Table 3-4 instead.

The retail service area, particularly the in-City portion, is highly urbanized, dense, and experiencing infill development. Open space and landscaped areas are limited, as are lot sizes. Build-out is planned or already under construction at the few, large undeveloped or redevelopment areas that remain, such as Candlestick Point/Hunters Point Shipyard, Treasure Island/Yerba Buena Island, Mission Bay, and Pier 70. Most of these areas are located along the eastern shoreline of the City. The majority of current and planned development is comprised of mixed-use, multi-family residential, and commercial high-rise buildings.

Housing unit estimates for San Francisco are based on the Housing Element 2022 Update objective, which plans to add an average of 5,000 housing units per year, or an approximate growth in housing units of 1.3% per year. It is projected that the number of single family detached houses will not increase, and it is anticipated that nearly all of the new housing built in San Francisco will be multi-family buildings. Currently, the ratio of multi-family households to single family households in the City is approximately 2:1 (i.e., one third of total housing is single family). As new housing is built, the majority of which will be multi-family units, the ratio will increase to over 3:1 (i.e., one fourth of total housing is single family) by 2040.

Retail demand projections presented in this 2020 UWMP (Section 4.1) are based on housing projections provided by the San Francisco Planning Department for the in-City retail service area and employment forecasts from the Association of Bay Area Governments (ABAG). Additional information about demographic data sources and assumptions supporting the retail demand projections can be found in Appendix E.

3.3 WHOLESALE SERVICE AREA

The SFPUC sells water to 26 wholesale customers (collectively referred to as the Wholesale Customers) under the terms of a 25-year contract known as the Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County (WSA). The SFPUC also sells water to two additional wholesale customers, Cordilleras MWC and Groveland CSD. These customers are further described below:

- **Wholesale Customers and BAWSCA:** Enabled by Assembly Bill (AB) 2058, BAWSCA was established on May 27, 2003 to represent the interests of 24 cities and water districts, as well as two other utilities, in Alameda, Santa Clara, and San Mateo Counties that purchase water on a wholesale basis from the RWS. The SFPUC sells water to these Wholesale Customers under the terms of the WSA and the individual water sales contracts that each of the Wholesale Customers have with the SFPUC. Since 1970, the SFPUC has supplied approximately 65% of the total Wholesale Customers' demand. Some of the Wholesale Customers are entirely reliant on the SFPUC for their supply.

- **Cordilleras MWC:** Cordilleras MWC serves a community of 18 single family homes in Emerald Hills, located in unincorporated San Mateo County. It is not considered an urban water supplier as defined by CWC Section 10617. It is not a member of BAWSCA, and not subject to the terms of the WSA. However, Cordilleras MWC has a water supply contract with the SFPUC for 3,007 CCF annually (about 0.006 mgd).

- **Groveland CSD:** As described in Section 2.4, Groveland CSD primarily serves residential and commercial customers in Groveland, located in a semi-rural area of southern Tuolumne County. Although Groveland CSD is considered a retail customer of the SFPUC and is accounted as such in the SFPUC's contractual obligations and supply planning, the SFPUC was directed by DWR to report Groveland CSD as a wholesale customer for the 2015 UWMP and maintains this distinction in the 2020 UWMP update. Therefore, Groveland CSD is included in the wholesale service area for the remainder of this section. It is not a member of BAWSCA, and not subject to the terms of the WSA.

The wholesale service area encompassing the Wholesale Customers, Cordilleras MWC, and Groveland CSD is shown in Error! Reference source not found..

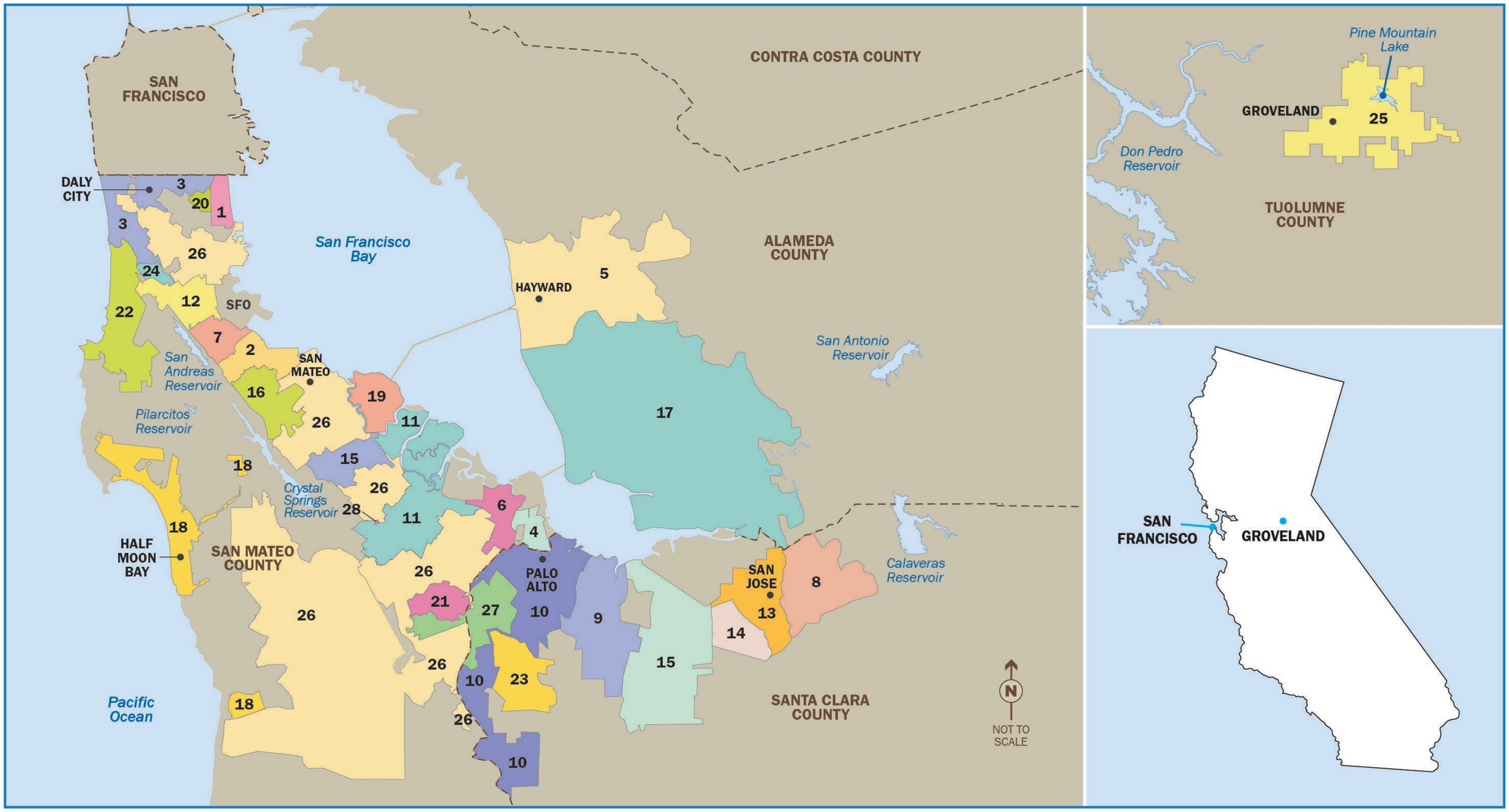
3.3.1 Climate

As described in Section 3.2.1 for the retail service area, the San Francisco Bay Area as a whole has a Mediterranean climate. Varied topography throughout the Bay Area creates numerous microclimates dependent upon elevation, proximity to the Bay or coast, orientation with respect to the ocean, and wind patterns. These microclimates also result in different rainfall amounts and evapotranspiration rates. However, in general, the Wholesale Customers and Cordilleras MWC experience a climate similar to the in-City retail service, except for customers located in the southern and inland regions that tend to experience warmer temperatures in the summer months with less incidence of fog.

Further inland in the Sierra Nevada foothills, Groveland CSD experiences hot, dry summers and mild winters. Most of Groveland CSD's service area is located at elevations of 2,800 to 3,300 feet, so is not subjected to the long, severe winters and heavy snowfall that are experienced at higher elevations above 5,000 feet.

For a discussion of climate change and potential impacts, see Section 6.1.3.

Figure 3-4. Wholesale Service Area



MUNICIPALITIES

1 City of Brisbane
2 City of Burlingame
3 City of Daly City
4 City of East Palo Alto
5 City of Hayward
6 City of Menlo Park
7 City of Millbrae
8 City of Milpitas
9 City of Mountain View
10 City of Palo Alto
11 City of Redwood City
12 City of San Bruno
13 City of San Jose[a]
14 City of Santa Clara[a]
15 City of Sunnyvale
16 Town of Hillsborough

WATER PURVEYING DISTRICTS

17 Alameda County Water District
18 Coastside County Water District
19 Estero Municipal Improvement District
20 Guadalupe Valley Municipal Improvement District
21 Mid-Peninsula Water District
22 North Coast County Water District
23 Purissima Hills Water District
24 Westborough Water District
25 Groveland Community Services District[b]

OTHER ENTITIES

26 California Water Service Company[c]
27 Stanford University
28 Cordilleras Mutual Water Company[d]

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[a] The SFPUC provides water on an interruptible basis to fixed service areas in the northern portions of the Cities of San Jose and Santa Clara.

[b] Groveland Community Services District is not a member of BAWSCA. For the purposes of the 2020 UWMP, Groveland is considered a retail customer in the context of the Water Supply Agreement and allocating Regional Water System supplies between retail customers and Wholesale Customers. However, Groveland is accounted for as a wholesale customer in the standardized tables provided in **Appendix B**.

[c] California Water Service Company, an investor-owned utility, provides water service to four separate districts: Bear Gulch (Atherton vicinity), San Carlos/San Mateo, South San Francisco, and Skyline County Water District.

[d] Cordilleras Mutual Water Company is not a member of BAWSCA.

3.3.2 Population and Demographics

As shown in Table 3-4, the total population in the wholesale service area is currently estimated to be about 1.86 million and is projected to increase to over 2.4 million by 2045. This corresponds to an average growth rate of about 1.2% per year.

Compared to the retail service area, the majority of which is the City of San Francisco, the wholesale service area is less dense and populated, but still fairly urbanized and built out. Single family homes are more prevalent and lot sizes are larger.

Table 3-4. Wholesale Service Area Population

[Standardized Table 3-1 Wholesale: Population - Current and Projected]

Wholesale Service Area	**Actual**	**Projected**				
	2020	**2025**	**2030**	**2035**	**2040**	**2045**
BAWSCA Member Agencies[a]	1,858,392	1,941,725	2,032,304	2,187,849	2,311,562	2,438,515
Cordilleras MWC[b]	64	64	64	64	64	64
Groveland CSD[c]	3,027	3,065	3,104	3,143	3,182	3,222
Total Wholesale	1,861,483	1,944,854	2,035,472	2,191,056	2,314,808	2,441,801

[a] Data provided by BAWSCA and published in BAWSCA's Regional Water Demand and Conservation Projections Report, June 2020.

[b] Data provided by Cordilleras MWC.

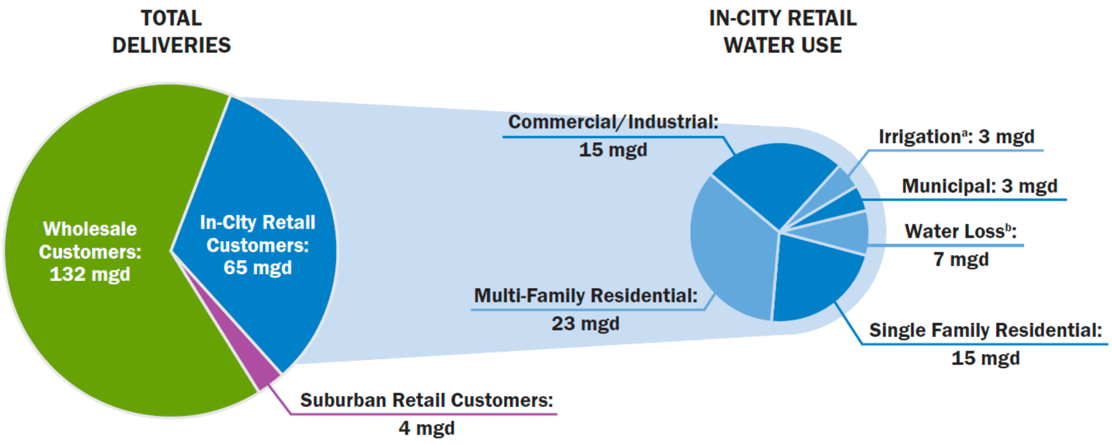
[c] Data provided by Groveland CSD (subject to change) and population projections are from Groveland CSD's 2015 UWMP and are according to a 0.25 percent annual growth rate estimate within the Groveland CSD service area through 2045.

SECTION 4: SYSTEM DEMANDS

This section describes and quantifies the current and projected water uses within the SFPUC's retail and wholesale service areas. Retail demand projections are based on recent demographic information and a detailed analysis of water use characteristics. Wholesale demand projections for RWS supplies were developed by the wholesale customers. Note that the terms "use," "demand," and "consumption" are used interchangeably. Additionally, water loss is included in total retail demands unless otherwise noted.

As described previously, approximately two thirds of the SFPUC's water supply is delivered to wholesale customers, and the remaining one third is delivered to retail customers. In 2020, the SFPUC delivered approximately 198 mgd of RWS supplies to its entire water service area, with an additional 2.3 mgd in local groundwater and recycled water provided to retail customers. Figure 4-1 shows the total volumes of water delivered to wholesale customers, in-City retail customers, and suburban retail customers. Approximate water use by sector in the in-City retail service area is also shown in Figure 4-1.

Figure 4-1. Total Deliveries and In-City Retail Water Use in 2020



[a] This data is from dedicated irrigation accounts only, and does notinclude irrigation use from water accounts that jointly serve both indoor and outdoor demands. Irrigation use includes use of local groundwater and recycled water.

[b] Water loss includes apparent losses (e.g. inaccuracies associated with customer billing, illegal use) and real losses (e.g. distribution system losses, main breaks). Unbilled, authorized consumption for operational uses (e.g. pipe flushing, street cleaning) has been included in the municipal category.

Note that Groveland CSD is accounted for differently between this section of the 2020 UWMP and the corresponding standardized tables in Appendix B. This section includes Groveland CSD in the estimation of retail demands because, in the context of RWS supply allocations between the SFPUC and its Wholesale Customers, Groveland CSD is a retail customer. Where retail demands are subsequently compared to retail supplies in Section 8. Groveland CSD is accounted for in both the retail demand and retail supply projections. In contrast, the standardized tables in Appendix B include Groveland CSD in the estimation of wholesale demands, as directed by DWR and explained in Section 2.4.

4.1 RETAIL DEMANDS

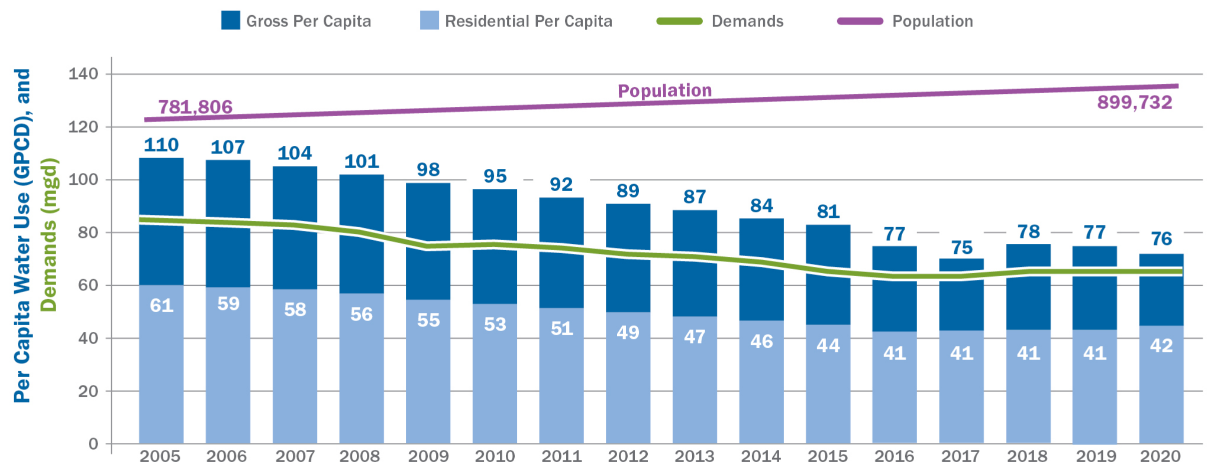
4.1.1 Current Retail Demands

Water use within San Francisco (i.e., the in-City retail service area) continues to be among the lowest in the State and below historical consumption. Both total consumption and per capita water use (i.e., gallons of water consumed per person per day [GPCD]) have been on a general decline since the mid-1970s. Many factors have contributed to this reduction in water use, including significant changes to the mix of industrial and commercial businesses and their associated water demand, and the general characteristics of water use by San Franciscans. In particular, the severe droughts of 1976-77 and 1987-92, changes in plumbing codes, and conservation programs (either voluntarily embraced by residents and businesses or mandated by the City) have affected water demands. During the most recent drought in 2012 – 2016 per capita water use further declined

As illustrated in Figure 4-2, per capita water use and deliveries for all retail customers (i.e., in-City and suburban) have declined over the past decade and have remained consistently low over the past five years. Figure 4-2 presents per capita water use on both a gross basis (i.e., water use by all sectors) and a residential basis (i.e., water use by the residential sector only). Currently, gross and residential per capita water use by in-City retail customers are 73 and 42 GPCD, respectively. Taking suburban retail customers into account, gross and residential per capita water use by all retail customers are 76 and 42 GPCD, respectively. These per capita rates are among the lowest in the State.

Since the summer of 2014, the SFPUC has reported total water production and residential per capita water use on a monthly basis to the SWRCB in compliance with its emergency conservation regulations. The SFPUC continued to report this data voluntarily to the SWRCB after the emergency conservation regulations adopted during the last drought ended. In April 2020, the SWRCB adopted a regulation making the monthly reporting permanent, and effective October 2020, it again became mandatory. The SFPUC monthly per capita rates have consistently been among the lowest reported by urban water suppliers in the State.

Figure 4-2. Trends in Retail Demands, Population, and Per Capita Use between 2005 and 2020



Residential population was estimated from total population by subtracting 3%, which represents population housed in group quarters. Group quarters are residences that are not housing units, e.g. correctional facilities, nursing homes, and shelters.

Total retail demand (including both in-City and suburban retail) in 2020 was 69 mgd, which is much lower than anticipated in the 2015 UWMP update. Of this demand, in-City retail customers used approximately 65.3 mgd (95% of total retail demand), of which 1.9 mgd was met with groundwater, 0.1 mgd was met with recycled water, and the remainder was met with RWS supplies. Suburban retail customers used approximately 3.7 mgd (5% of total retail demand), of which 0.3 mgd was met with groundwater and the remainder was met with RWS supplies. Total retail water loss, including both real and apparent losses, was estimated to be 7.18 mgd.

The SFPUC's retail demands are generally tracked and projected by each of the major sectors outlined below. Current retail demands for each of these sectors are shown alongside projected demands in Table 4-1.

- **Single Family Residential:** Single family households currently comprise approximately one third of the total households in the City, though this proportion is declining. This sector represents approximately 20% of total retail demand. Due to the Bay Area's moderate climate and high-density housing, especially in the City, residential water use is primarily indoors. Outdoor water use is estimated to be about 20% of single family residential use, on average.

- **Multi-Family Residential:** Multi-family households include apartments, condominiums, and townhouses. This sector comprises approximately two thirds of the total households in the City, and this proportion is increasing. This sector represents approximately 30% of total retail demand. Average outdoor water use is limited since outdoor space for many multi-family households are generally limited to patios and shared spaces, if any.

- **Non-residential:** This sector includes all sectors of water users not designated as residential and includes commercial, industrial, institutional, and municipal uses, as well as irrigation through dedicated meters. Non-residential water use represents approximately 40% of total retail demand.

- **Water Loss:** Water loss is defined as the difference between the quantity of water supplied to customers and the quantity of water actually consumed by customers. It is comprised of both apparent losses and real losses. Water loss typically represents less than 10% of total retail demand. For more information on water loss, see Section 4.1.3 and Appendix G.

One factor that impacted demands in FY 19-20 was the COVID-19 pandemic and the shelter in place order that was issued in March 2020. There was a shift in water demand as a result of people remaining at home and office building occupancy decreasing. As part of the retail demand forecasting, the impact of COVID-19 on water demand was estimated by sector. For the residential sectors, there was an estimated increase of 9% for the single-family and 6% for multi-family sectors. In the commercial and industrial sectors, the estimated change was a decrease of 40 - 57%. These changes may account for a lower level of retail demand than would otherwise have occurred.

4.1.2 Projected Retail Demands

4.1.2.1 Methodology Used to Project Retail Demands

Beginning in 2015, the SFPUC transitioned away from an end use-based model to an econometric model for demand forecasts. Econometric models incorporate socioeconomic factors to project demands and are able to capture a more complete demand picture. This demand forecasting methodology is becoming more prevalent among urban water utilities and managers. The demand forecasts shown in Table 4-1 below are comprised of the following components:

- **In-City Single Family, Multi-Family, and Commercial/Industrial Demands**: Econometric models are used to project the demands for these sectors. Detailed information about these models is provided in Appendix E.

    - Active conservation savings are savings achieved through SFPUC conservation program activities, such as fixture incentives and leak alerts. The models explicitly incorporate active conservation savings. These savings were estimated by the SFPUC using an end-use-based water savings accounting model. This model is customized for the SFPUC from the Alliance for Water Efficiency Water Conservation Tracking Tool. Additional information about this customized model, referred to as the SFPUC Water Conservation Tracking Model, is provided in Appendix G.
    - Passive conservation savings are savings that are achieved through natural fixture replacement and tightening of the plumbing code over time. In an effort to avoid double-counting of passive conservation savings, the passive savings estimated by the SFPUC Water Conservation Tracking Model were not subtracted from the modeled demands. It is assumed that some passive savings are accounted for in the response of demands to changes in water rates, e.g., when water rates increase, people may respond by replacing inefficient fixtures to reduce water consumption. Single family, multi-family, and commercial and industrial sectors all show a strong relationship between increasing water rates and decreasing water demands. Although all passive savings may not be accounted for in this rates impact, subtracting passive savings that were estimated separately would likely result in a double counting of conservation savings. For an estimate of both the passive and active conservation savings, refer to SFPUC's Retail Water Conservation Plan[6].
    - The models incorporate savings from onsite water reuse. These savings were estimated by SFPUC staff. Additional information about this estimate can be found in Section 4.1.4.

- **Other in-City Non-Residential Retail Demands (i.e., irrigation and municipal) and Suburban Retail Demands**: These demands are estimated based on historical consumption and supplement the demands projected by the econometric models described above. These demands are assumed to be constant through 2040 since no significant growth is anticipated among these sectors.

- **Water Loss**: Water loss is forecasted separately and is described in Section 4.1.3.

A key new aspect of the retail demand projections in this 2020 UWMP update is that the econometric models were calibrated using 10 years (2010-2020) of historical San Francisco account-level water usage data. This data was combined with property characteristics, demographic characteristics, and historical climate data to create an econometric model that evaluates the impact of several factors on household-level demands. Demands are then projected based on the growth assumptions discussed below, along with expected future changes in rates and climate.

The new set of models relies on household and employment forecasts provided by the San Francisco Planning Department. The housing projections are based on the growth scenario being evaluated as part of the 2022 update to the Housing Element of the San Francisco General Plan. The employment forecasts are from the Planning Department's Land Use Allocation (LUA) 2017, which is a City-specific refinement of ABAG's growth forecasts, ABAG Projections 2017, which reflect the growth that is assumed in ABAG's Plan Bay Area and Sustainable Communities Strategy Jobs-Housing Connections Scenario.

In the 2015 UWMP's demand projections, commercial and industrial demands were aggregated and based only on total employment, not sector-specific characteristics. In the updated models for this 2020 UWMP, the commercial and industrial

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[6] The Retail Water Conservation Plan provides an overview of the retail water conservation program, the factors that shaped the program, estimated water savings, and the program's effect on the overall retail water demand forecast. The Conservation Plan is a key element of the SFPUC's water supply management and planning, and is updated every five years to coincide with each UWMP update. The Conservation Plan may be accessed online at **https://sfpuc.org/learning/conserve-water**.

sector model accounts for employment distributed across a variety of sectors, such as office/professional, manufacturing, health, and education.

The demand forecasts for the three sectors modeled with an econometric model (single family, multi-family, and commercial/industrial) were grown from a normalized base year, i.e. the FY19-20 demands were normalized to represent an average year. The impacts of the COVID-19 pandemic were removed, and the demands were adjusted to reflect average temperature conditions. Normalizing the base year for demand forecasting removes the impact of idiosyncrasies that make any given year different from the average year, rather than assuming that these idiosyncrasies will continue in all future years.

Separately, Groveland CSD prepared its own demand projections for use in its 2020 UWMP update. The projected demands were estimated by multiplying projected population by the 2020 target daily per capita water use (107 GPCD) as reported in Groveland CSD's 2015 UWMP. Groveland CSD provided these projections to the SFPUC to report as part of the SFPUC's wholesale demands in the standardized tables of this 2020 UWMP update (see Appendix B). However, in the body of this 2020 UWMP, Groveland CSD's demands are included in retail demands. These demand projections are subject to change as part of Groveland CSD's UWMP process.

4.1.2.2 Retail Demand Projections by Sector

Table 4-1 presents the updated retail demand projections by sector for 2025 through 2045. The updated projections result in a total retail demand of 77.5 mgd in 2040, which is 12.9 mgd lower than the corresponding projection in the 2015 UWMP. (The 2015 UWMP did not include projections for 2045.)

Table 4-1. Retail Demands (mgd)

[Standardized Table 4-1 Retail: Demands for Potable and Raw Water - Actual]
[Standardized Table 4-2 Retail: Demands for Potable and Raw Water - Projected]
[Standardized Table 4-3 Retail: Total Water Demands]
[Standardized Table 6-4 Retail: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area]

Retail Sector or Use Type	Actual[a]	Projected[b]				
	2020	2025	2030	2035	2040	2045
In-City Retail						
Single Family Residential	14.5	13.7	13.5	13.4	13.5	13.5
Multi-Family Residential	*22.9*	*23.7*	*25.6*	*27.9*	*30.3*	*33.0*
Non-residential	20.9	22.9	22.9	22.8	23.1	23.6
Water Loss[c]	7.2	6.0	6.0	6.0	6.0	6.0
Subtotal In-City Retail Demand	65.3	66.3	68.0	70.0	72.9	76.2
Suburban Retail						
Single Family Residential[d]	0.1	0.1	0.1	0.1	0.1	0.1
Non-residential	3.1	4	4	4	4	4
Groveland CSD[e]	0.3	0.3	0.3	0.3	0.3	0.3
Water Loss[c]	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal Suburban Retail Demand	3.5	4.4	4.4	4.4	4.4	4.4
Total Retail Demand	**68.8**	**70.7**	**72.4**	**74.5**	**77.4**	**80.6**

[a] Actual consumption data are obtained from customer billing data.

[b] Single family residential and multi-family residential demand projections are from an econometric model developed for the SFPUC. Non-residential demands include commercial/industrial demands, which are also from an econometric model, as well as municipal and irrigation demands, which are assumed to remain constant at the previous five-year average level.

[c] Water losses include both apparent and real losses. Suburban retail water losses are considered to be negligible. Estimate of actual water loss in 2020 is based on a draft audit under review as of the publication of this 2020 UWMP.

[d] Suburban retail residential demands are for single family only as no multi-family residential buildings are served.

[e] Groveland CSD is accounted for as a retail customer for the purpose of this table and subsequent retail supply and demand comparisons. Demand projections were provided by Groveland CSD based on its population projections and assumed per capita water use of 107 GPCD (projections are subject to change as part of its UWMP process). In the corresponding standardized tables in Appendix B, Groveland CSD is not reported as retail, but rather wholesale.

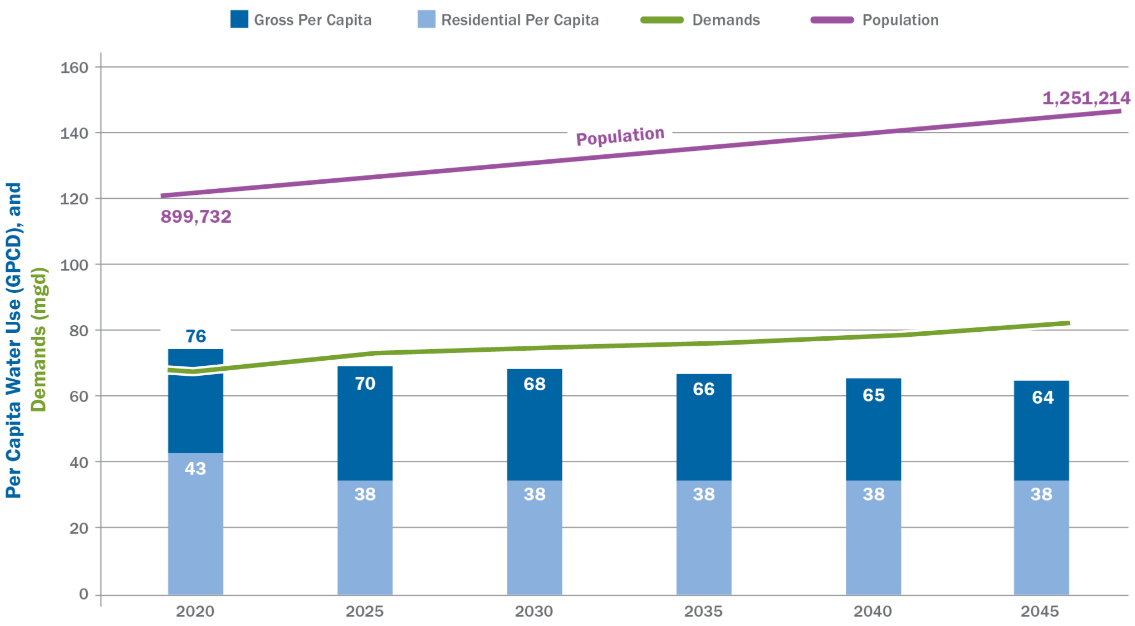
Demand is forecasted to increase steadily through 2045, with more rapid growth happening in the later years of the projection period. After accounting for the projected conservation savings, the total retail demand (excluding water loss) is projected to increase by about 21%, from 61.6 mgd in 2020 to 74.6 mgd in 2045. Although population and total retail water demand are projected to increase, gross and residential per capita water usage are both forecasted to decrease (see Figure 4-3).

Both the projected demands and conservation savings are conservative as unanticipated new building codes, standards, and programs that increase water efficiency and reduce water use will likely be implemented. A closer analysis of the estimated conservation savings is provided in the Retail Water Conservation Plan. Sector-specific observations are summarized below:

- **Single Family Residential:** Single family residential water use is projected to decrease by 7% between 2020 and 2045. Unlike the 2015 UWMP, the 2020 demand forecasts assume that no new single family homes will be constructed in the retail service area over the planning horizon. In-City single family residential demands are modeled as a function of socioeconomic factors that include water price, precipitation, and temperature. Single family per household usage is expected to decline as a result of conservation savings and responses to rate increases.

- **Multi-Family Residential:** Multi-family residential water use is projected to increase by 44% between 2020 and 2045. In-City multi-family residential demands are modeled as a function of the price of water, temperature, and precipitation. Compared to single family residential demands, multi-family residential demands are more responsive to price, but less responsive to increases in temperature or decreases in precipitation. Multi-family households have relatively little outdoor water use..
- **Non-residential:** Non-residential water use is projected to increase by 13% between 2020 and 2045. While the growth in in-City non-residential demands is directly related to the growth in employment, commercial and industrial water demands also reflect socioeconomic factors including price, precipitation, and temperature. As the price of water increases, the amount of water consumed per employee decreases.
- **Water Loss:** Water loss is projected to be a constant 6.0 mgd between 2020 and 2045 for planning purposes. More information on water loss projections is provided in the next section.

Figure 4-3. Projected Retail Demands, Population, and Per Capita Water Use.



Residential population was estimated from total population by subtracting 3%, which represents population housed in group quarters. Group quarters are residences that are not housing units, e.g. correctional facilities, nursing homes, and shelters.

4.1.3 Retail Distribution System Water Losses

Water loss is defined as the difference between the quantity of water supplied to customers and the quantity of water actually consumed by customers or other authorized uses. It is comprised of (1) apparent losses, which include inaccuracies associated with customer metering, estimated systematic data handling errors, and theft or illegal use; and (2) real losses, which include all water physically lost due to distribution system leaks, breaks, or overflows. In short, real losses are equivalent to distribution system water losses. Water loss in the retail service area ranges from 5 to 7 mgd annually, which is typically less than 10% of total retail demand.

The SFPUC has conducted water loss audits of its retail water system in accordance with the methods in AWWA's Manual of Water Supply Practices - M36, "Water Audits and Loss Control Programs" and Free Water Audit Software, pursuant to section 10608.34 of the Water Code. The water loss audits were validated following the California Water Code of Regulations and submitted annually to DWR. The results of the water loss audits from the past five years are reported in Table 4-2; these include both apparent and real losses, as calculated in the AWWA worksheet. Water loss in FY19 audit, water loss in FY 2019-20 was determined to be 7.18 mgd, of which 6.0 mgd was attributed to real losses. The AWWA worksheet is provided in Appendix G.

Table 4-2: Retail Annual Water Losses over the Past Five Years

Submittal Table 4-4 Retail: 12 Month Water Loss Audit Reporting

Reporting Period Start Date (mm/yyyy)	Volume of Water loss (MG/yr)
07/2015	2,200.13
07/2016	1,899.82
07/2017	2,199.14
07/2018	2,253.01
07/2019	2,720.01

For planning purposes, the SFPUC projects total water loss in its in-City retail service area to be a flat 6.0 mgd through 2045. This estimate reflects, among other things, the anticipation of leaks and breaks due to aging infrastructure, continuance of system flushing as necessary, and active management of losses (described below). Because apparent losses are not projected separately, the SFPUC's total projection for in-City water loss is a conservative estimate and reported as such in this 2020 UWMP.

Nearly all of the SFPUC's suburban retail customers are located immediately off of RWS transmission pipelines. Therefore, real losses in the suburban retail service area are assumed to be negligible and reported as such in this 2020 UWMP. As described in Section 3.1.5.2, the SFPUC operates the Castlewood Well System and the Town of Sunol domestic water system. However, the extent of distribution in the Castlewood Well System is limited from the well field to the control tank and reservoir; the system is not connected to the RWS. There is no master meter to the Town of Sunol, so loss in the Town of Sunol system cannot be directly measured. The primary source of water loss in the Town of Sunol is system maintenance flushing, which would occur regularly at a rate of 10,000 gallons per week for 50 weeks per year, or roughly 0.001 mgd (1.5 AF). These losses in the suburban retail service area are considered to be negligible.

The SFPUC manages real losses through its Automated Water Meter Program and Linear Assets Management Program. Deployment of the Automated Water Meter Program began in the spring of 2010 to upgrade all in-City retail water meters with wireless advanced metering technology. By 2013, 96% of meters were converted to Advanced Metering Infrastructure (AMI), and by 2020, 99.5% have been converted. The Linear Assets Management Program replaces and renews distribution system pipelines and customer service connections for approximately 1,250 miles of drinking water mains in the City. More information about management of retail system losses is provided in Section 10.2.5.

4.1.4 Onsite Water Reuse Water Savings

This 2020 UWMP update accounts for the water supply savings from buildings that install and operate onsite water reuse systems as a type of conservation savings. The water supplies produced by these systems are not municipally-supplied by the SFPUC, and they serve to reduce demands on SFPUC's system.

In September 2012, the City adopted the Onsite Water Reuse for Commercial, Multi-family, and Mixed Use Development Ordinance (Ordinance 195-12[7]). Commonly known as the Non-potable Water Ordinance, this ordinance added Article 12C to the San Francisco Health Code, allowing for the collection, treatment, and use of alternate water sources for non-potable applications. The ordinance also established the Non-potable Water Program, since re-named the Onsite Water Reuse Program, which provides grant funding for projects meeting specific eligibility criteria.

In October 2013, the ordinance was amended to allow district-scale water systems consisting of two or more buildings sharing non-potable water. Article 12C was further amended in July 2015 to mandate the installation of onsite water systems in new developments meeting specified criteria. Beginning November 1, 2015, all new development projects of 250,000 square feet or more of gross floor area located within the boundaries of San Francisco's designated recycled water use areas, as defined by the Recycled Water Ordinance, must install onsite water systems to treat and reuse available alternate water sources for toilet and urinal flushing and irrigation. This requirement expanded to the entire City the following year, on November 1, 2016. While not required to install an onsite water system under Article 12C, developments between 40,000 and 250,000 square feet of gross floor area must submit a water budget application and accompanying Water Use Calculator to the SFPUC. Additional guidelines and rules were published in 2017 for development projects implementing district-scale non-potable water systems.

Onsite water systems are operated, maintained, and monitored by the property owner. Under the Onsite Water Reuse Program, the San Francisco Department of Public Health-Environmental Health (SFDPH-EH) has established ongoing monitoring requirements and water quality standards that are protective of public health. Different treatment levels are required depending on the alternate water source and end use. The frequency of monitoring and reporting also vary depending on the alternate water source, and they are identified in the SFDPH's *Director's Rules and Regulations Regarding the Operation of Alternate Water Source Systems* and the operating permit for the onsite water system issued by the SFDPH-EH.

In addition to projects that install mandatory onsite water reuse systems in accordance with the Non-Potable Ordinance, there are several projects that have voluntarily implemented onsite reuse. Some of these have received grants from the SFPUC. The SFPUC also offers grant funding to breweries to collect, treat, and reuse process water (e.g. water used in the brewing process for applications such as rinsing bottles and cleaning equipment) generated onsite. The grant program includes water quality, treatment, and monitoring standards for brewery process water reuse systems.

The SFPUC received 21 water budget applications to install onsite water systems in FY 2019-2020, with a total of 119 water budget applications reviewed by the SFPUC since the beginning of the Onsite Water Reuse Program. SFPUC staff also maintain a database of future projects that have not yet submitted water budget applications, but will have to comply with the Non-Potable Water Ordinance based on their proposed gross square footage. Using existing water budget applications and the assumptions in the SFPUC's Water Use Calculator, staff have estimated the future potable offsets that will be achieved by all known onsite water reuse projects, as shown in Table 4-2. Note that this is a conservative estimate of future savings because it does not include savings from future unknown projects that are assumed in the demand forecasts; as these projects do not yet exist, no information about them is available to estimate the offsets from their potential onsite water reuse systems.

It is estimated that the Onsite Water Reuse Program (both mandatory and voluntary projects) will generate a total potable water offset of approximately 1.3 mgd by 2040, which will be sustained through 2045.

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[7] San Francisco Health Code, Article 12C, Sections 850-861. Note that this ordinance was amended in October 2013 by Ordinance 208-13 to allow district-scale water systems, and in July 2015 by Ordinance 109-15 to mandate installation of onsite water systems in new development meeting specified criteria.

Table 4-2. Onsite Water Reuse Program Potable Offsets (mgd)

	Actual[a]	Projected[b]				
	2020	2025	2030	2035	2040	2045
Onsite Water Reuse Savings	0.1	0.3	0.5	0.9	1.3	1.3

[a] Actual onsite water reuse potable offsets are obtained from existing onsite water reuse projects water budget applications.

[b] Projected potable offsets are based on water budget applications submitted to the SFPUC, as well as assumptions about future projects that have not yet submitted water budget applications but are known to need to comply with the Non-Potable Water Ordinance.

4.1.5 Demands of Lower Income Households

The Act requires water suppliers to separately estimate future demands for lower income households (i.e., those with less than 80% of the area median income). This section documents the SFPUC's best effort to do so. However, please note that the SFPUC does not use this estimate for any planning purposes. The demands of lower income households are included in the demand projections presented about in Table 4-1.

Projected water use by lower income households is estimated by multiplying the planned future housing units for lower income residents by the estimated per household water use. This analysis, detailed below, is only performed for the in-City retail service area as lower income demands are primarily located in the City.

As described above, the demand projections presented here are based on housing growth projections from the 2022 update to the Housing Element of the San Francisco General Plan. The assumption used in the Housing Element is that 33% of future housing growth will be in lower income housing. Projected household growth between 2020 and 2025 is 25,805 new multi-family units. Based on the Housing Element's assumptions, that translates to 8,516 lower income households.

Based on the multi-family sector model (for additional information, see Appendix E), per household water use for future multi-family households is projected to be 78.7 gallons per household per day in 2025 (at an assumed occupancy rate of 2.3 persons per household, this translates to a per capita rate of about 34 gpcd). At this rate of household use, the demand in 2025 from 8,516 new lower income housing units will be an estimated 0.7 mgd.

5.2This estimate of lower income water demand is reflected in the retail demand projections presented in Table 4-1. Lower income housing growth and demands have always been included in the SFPUC's retail demand projections and, subsequently, its related planning efforts.

4.2 WHOLESALE DEMANDS

As noted above and discussed in further detail below, the SFPUC sells water to 26 wholesale customers (collectively referred to as the Wholesale Customers) under the terms of a 25-year contract known as the Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County (WSA) and associated individual water sales contracts with each Wholesale Customer. Collectively, the Wholesale Customers receive over two thirds of the SFPUC's supply. Of the 26 Wholesale Customers, 11 rely on the SFPUC for 100% of their total supply. The remaining 15 Wholesale Customers rely on the SFPUC for a portion of their supply, but also use other local and imported supplies to meet their water customers' needs, including, but not limited to local groundwater and surface water, and purchases from the Santa Clara Valley Water District and the State Water Project.

In addition to the 26 Wholesale Customers, the SFPUC also provides water on a wholesale basis to Cordilleras MWC in San Mateo County and Groveland CSD in Tuolumne County. Cordilleras MWC relies entirely on the SFPUC for its supply, and

Groveland CSD relies on the SFPUC for the majority of its supply. The demands of these two additional wholesale customers are small compared to the collective demands of the other Wholesale Customers.

4.2.1 Wholesale Water Contractual Obligations

The following section describes the water supply contracts that the SFPUC has with the Wholesale Customers.

4.2.1.1 Water Supply Agreement and Individual Water Sales Contracts

The WSA became effective on July 1, 2009, as its predecessor agreement, the 1984 Settlement Agreement and Master Water Sales Contract between the SFPUC and the Wholesale Customers (1984 Agreement), expired. The WSA, as amended and restated in December 2018, describes the current contractual relationship between the SFPUC and the Wholesale Customers.

The WSA carries forward many components of the 1984 Agreement, including the SFPUC's "Supply Assurance" of 184 mgd to the Wholesale Customers. The SFPUC has agreed to deliver water to the Wholesale Customers up to the amount of the Supply Assurance, and this agreement is perpetual and survives the expiration of the WSA. The Supply Assurance is, however, subject to reduction due to water shortage, drought, scheduled RWS maintenance activities, and emergencies.

The Supply Assurance is shared among 24 of the 26 Wholesale Customers (all Wholesale Customers, except the Cities of San Jose and Santa Clara, as discussed in Section 4.2.1.2 below). Twenty-three of these 24 Wholesale Customers have an "Individual Supply Guarantee" (ISG), which represents their dedicated individual share of the 184 mgd Supply Assurance. The ISGs are also perpetual and survive the expiration of the WSA. The City of Hayward is the 24th Wholesale Customer, and it does not have an ISG due to the terms of its 1962 individual water supply contract with the SFPUC that did not contain a fixed allocation of water. The City of Hayward's unspecified water supply allocation is included in the Supply Assurance as the difference between 184 mgd and the sum of the other 23 Wholesale Customers' ISGs. In the event that Hayward's water use exceeds its unspecified water supply allocation, the 23 Wholesale Customers with ISGs would be required to reduce their individual ISGs to accommodate the demands of Hayward.

Each of the 26 Wholesale Customers also has an individual water sales contract with the SFPUC that describes the service area of the customer, identifies the location and size of service connections between the RWS and the customer's distribution systems, and in some instances contain additional specific provisions unique to the particular customer. The individual water sales contracts may be amended from time to time by the SFPUC and the applicable Wholesale Customers pursuant to the terms of the WSA.

4.2.1.2 Interruptible Customers

As noted above, the Cities of San Jose and Santa Clara are not included in the Supply Assurance, and they do not have an ISG, because the SFPUC has provided water to them on a temporary and interruptible basis under the 1984 Agreement and the WSA. While the SFPUC has never interrupted water supply to San Jose and Santa Clara, the WSA allows the SFPUC to issue a conditional notice of termination of supply if sufficient long-term water supplies from the RWS are not available. The SFPUC has committed to making a decision by 2028 about whether or not to make San Jose and Santa Clara permanent customers of the RWS. Additional discussion about the San Jose and Santa Clara and the 2028 decision can be found in Section 7.3.3.

4.2.2 Wholesale Demands

Wholesale demands reached a historic low during the most recent drought and have increased slightly since the end of the drought. As shown in Table 4-3, RWS supplies purchased by the SFPUC's wholesale customers in 2020 totaled 132.1 mgd.

In 2020, BAWSCA updated the demand projections of its member agencies (26 of the SFPUC's 28 wholesale customers) using a combination of two different models: (1) an econometric (or statistical) model developed for each member agency and (2) the Demand Side Management Least Cost Planning Decision Support System (a.k.a., DSS Model). BAWSCA's population projections for its member agencies are based on each member agency's population projections, ABAG Plan Bay Area 2040 data, California Department of Finance, the U.S. Census, and agency planning documents. The forecast methodology and resulting projections are documented in BAWSCA's 2020 report titled "Regional Water Demand and Conservation Projections," and they support BAWSCA's Long-Term Reliable Water Supply Strategy (Strategy). The Strategy's projections indicate that demands by the Wholesale Customers for RWS supplies through 2045 will be significantly less than anticipated at the time the Phased WSIP was adopted in 2008. BAWSCA's member agencies that are urban water suppliers preparing an individual 2020 UWMP are in some cases using the projections developed for the Strategy, and in other cases using their own set of projections. Table 4-3 provides each Wholesale Customer's projected purchase requests for RWS supplies through 2045 provided to the SFPUC by BAWSCA.

Given the SFPUC's Supply Assurance to the Wholesale Customers described above, this 2020 UWMP also presents the wholesale demands based on contract obligations in Table 4-4.

Regarding the SFPUC's two additional wholesale customers, the demand projections for Cordilleras MWC shown in Table 4-3 are based on the SFPUC's knowledge of the small, residential-only service area for that customer where no growth is anticipated. As noted earlier, the demand projections for Groveland CSD are presented as part of retail demands in Table 4-1 in the body of this 2020 UWMP, but as part of wholesale demands in the corresponding standardized tables in Appendix B.

4.3 CLIMATE CHANGE IMPACTS TO DEMAND

The retail demand modeling included a sensitivity analysis that modeled a range of future temperature and precipitation conditions. The baseline assumptions for temperature and precipitation were an increase in average temperature of 1.1°C by 2045 and no change in average annual precipitation. The two other scenarios considered were a "hot and dry" scenario, which assumed a 1.7°C increase in temperature and an 8.3% decline in precipitation by 2045 relative to 2020; and a "wet and slower warming" scenario where average temperature increased by 0.5 °C and precipitation increased by 8.3% by 2045 relative to 2020. The demand forecasts for these three scenarios were not significantly different. For example, in the single-family sector model—where we might expect the biggest impact due to more outdoor water use—the unadjusted per-unit demand forecast (i.e. the forecast before being adjusted for conservation savings) in 2045 under the baseline conditions is 109.9 gallons per day (gpd). In the "hot and dry" scenario, the per-unit forecast in 2045 is 110.3 gpd, and in the "wet and slower warming" scenario it is 109.8 gpd. The impacts in the multi-family and commercial and industrial sector models are similarly small (see Appendix E for additional information).

The fact that the SFPUC's projected retail demands are not significantly impacted by future changes in temperature and precipitation as described above is likely primarily due to the fact that irrigation demands in the SFPUC's retail service area are relatively low due to the dense urban environment, especially in the City. Therefore, the potential increase in irrigation demand as a result of increased temperature or decreased precipitation is low.

Table 4-3. Wholesale Purchase Requests (mgd)

[Standardized Table 4-1 Wholesale: Demands for Potable and Raw Water - Actual]

[Standardized Table 4-2 Wholesale: Demands for Potable and Raw Water - Projected]

[Standardized Table 4-3 Wholesale: Total Water Demands]

Wholesale Customer	ISG[a]	Actual 2020 Purchases[b]	Purchase Request[c]				
			2025	2030	2035	2040	2045
Alameda County Water District	13.76	7.76	7.68	7.68	7.68	7.68	9.11
City of Brisbane / Guadalupe Valley Municipal Improvement District[d]	0.98	0.63	0.89	0.89	0.88	0.89	0.89
City of Burlingame	5.23	3.48	4.33	4.40	4.47	4.58	4.69
California Water Service Company	35.68	29.02	29.99	29.74	29.81	30.27	30.70
Coastside County Water District	2.18	0.88	1.40	1.38	1.36	1.33	1.33
City of Daly City	4.29	3.92	3.57	3.52	3.49	3.46	3.43
City of East Palo Alto	1.96	1.57	1.88	1.95	2.10	2.49	2.89
Estero Municipal Improvement District	5.90	4.34	4.07	4.11	4.18	4.23	4.38
City of Hayward	22.08	14.20	17.86	18.68	19.75	20.82	22.14
Town of Hillsborough	4.09	2.57	3.26	3.25	3.26	3.26	2.26
City of Menlo Park	4.46	2.82	3.55	3.68	3.87	4.06	4.29
Mid-Peninsula Water District	3.89	2.66	2.86	2.84	2.88	2.89	2.93
City of Millbrae	3.15	1.90	2.29	2.50	2.45	2.82	3.20
City of Milpitas	9.23	6.06	6.59	6.75	7.03	7.27	7.53
City of Mountain View	13.46	7.60	8.60	8.90	9.20	9.51	9.93
North Coast County Water District	3.84	2.28	2.34	2.33	2.34	2.34	2.34
City of Palo Alto	17.08	9.75	10.06	10.15	10.28	10.51	10.79
Purissima Hills Water District	1.63	1.71	2.09	2.09	2.12	2.13	2.15
City of Redwood City	10.93	8.75	8.46	8.49	8.64	8.74	8.90
City of San Bruno	3.25	0.96	3.24	3.22	3.20	3.20	3.21
Stanford University	3.03	1.43	2.01	2.18	2.35	2.53	2.70
City of Sunnyvale	12.58	9.43	9.16	9.3	10.70	11.44	12.10
Westborough County Water District	1.32	0.87	0.86	0.85	0.85	0.84	0.84
Cordilleras Mutual Water Company[e]	—	0.01	0.01	0.01	0.01	0.01	0.01
Subtotal Permanent Customer Purchase Requests	**184.0**	**124.6**	**137.05**	**138.89**	**142.90**	**147.30**	**153.74**
City of San Jose	0.00	4.23	4.50	4.50	4.50	4.50	4.50
City of Santa Clara	0.00	3.29	4.50	4.50	4.50	4.50	4.50
Total Wholesale Purchase Requests	**—**	**132.1**	**146.05**	**147.89**	**151.90**	**156.30**	**162.74**

[a] Individual Supply Guarantee (ISG) refers to each Wholesale Customer’s share of the Supply Assurance as defined in the Water Supply Agreement (WSA). The Supply Assurance is the 184 mgd maximum annual average metered supply of water dedicated by San Francisco to public use in the Wholesale Customer service area (not including the Cities of San Jose and Santa Clara). The City of Hayward’s ISG is calculated as 184 mgd less the total of permanent customer ISGs (161.92 mgd).

[b] Actual demands are equivalent to purchases as reported in customer billing data.

[c] Purchase requests for RWS supplies as anticipated to be reported in each agency’s individual 2020 UWMP if one is to be prepared (estimates are subject to change). Projections were provided to the SFPUC by BAWSCA in January 2021. See each agency’s 2020 UWMPs for their most up to date purchase request projections.

[d] The City of Brisbane and Guadalupe Valley Municipal Improvement District are two Wholesale Customers that are jointly operated.

[e] Cordilleras MWC is not a member of BAWSCA or a party to the WSA, and therefore does not have an ISG.

Note: Groveland CSD is not accounted for as a wholesale customer for the purpose of this table and subsequent wholesale supply and demand comparisons. Refer to Table 4-1 for Groveland CSD’s current and projected demands. However, in the corresponding standardized tables in Appendix B, Groveland CSD is reported as wholesale rather than retail.

Table 4-4. Wholesale Contractual Obligations (mgd)

[Standardized Table Not Applicable]

Wholesale Customer	**ISG**[a]	**Actual 2020 Purchases**[b]	**Contractual Obligation**[c]				
			2020	**2025**	**2030**	**2035**	**2040**
Alameda County Water District	13.76	7.76	13.76	13.76	13.76	13.76	13.76
City of Brisbane / Guadalupe Valley Municipal Improvement District[d]	0.98	0.63	0.98	0.98	0.98	0.98	0.98
City of Burlingame	5.23	3.48	5.23	5.23	5.23	5.23	5.23
California Water Service Company	35.68	29.02	35.68	35.68	35.68	35.68	35.68
Coastside County Water District	2.18	0.88	2.18	2.18	2.18	2.18	2.18
City of Daly City	4.29	3.92	4.29	4.29	4.29	4.29	4.29
City of East Palo Alto	1.96	1.57	1.96	1.96	1.96	1.96	1.96
Estero Municipal Improvement District	5.90	4.34	5.90	5.90	5.90	5.90	5.90
City of Hayward	22.08	14.20	22.08	22.08	22.08	22.08	22.08
Town of Hillsborough	4.09	2.57	4.09	4.09	4.09	4.09	4.09
City of Menlo Park	4.46	2.82	4.46	4.46	4.46	4.46	4.46
Mid-Peninsula Water District	3.89	2.66	3.89	3.89	3.89	3.89	3.89
City of Millbrae	3.15	1.90	3.15	3.15	3.15	3.15	3.15
City of Milpitas	9.23	6.06	9.23	9.23	9.23	9.23	9.23
City of Mountain View	13.46	7.60	13.46	13.46	13.46	13.46	13.46
North Coast County Water District	3.84	2.28	3.84	3.84	3.84	3.84	3.84
City of Palo Alto	17.08	9.75	17.08	17.08	17.08	17.08	17.08
Purissima Hills Water District	1.63	1.71	1.63	1.63	1.63	1.63	1.63
City of Redwood City	10.93	8.75	10.93	10.93	10.93	10.93	10.93
City of San Bruno	3.25	0.96	3.25	3.25	3.25	3.25	3.25
City of San Jose[e]	0.00	4.23	0.00	0.00	0.00	0.00	0.00
City of Santa Clara[e]	0.00	3.29	0.00	0.00	0.00	0.00	0.00
Stanford University	3.03	1.43	3.03	3.03	3.03	3.03	3.03
City of Sunnyvale	12.58	9.43	12.58	12.58	12.58	12.58	12.58
Westborough County Water District	1.32	0.87	1.32	1.32	1.32	1.32	1.32
Subtotal BAWSCA Member Agency Demand	**184.0**	**132.1**	**184.0**	**184.0**	**184.0**	**184.0**	**184.0**
Cordilleras Mutual Water Company[f]	—	0.01	0.01	0.01	0.01	0.01	0.01
Total Wholesale Demand[i]	**—**	**132.1**	**184.0**	**184.0**	**184.0**	**184.0**	**184.0**

a Individual Supply Guarantee (ISG) refers to each Wholesale Customer's share of the Supply Assurance as defined in the Water Supply Agreement (WSA). The Supply Assurance is the 184 mgd maximum annual average metered supply of water dedicated by San Francisco to public use in the Wholesale Customer service area (not including the Cities of San Jose and Santa Clara). The City of Hayward's ISG is calculated as 184 mgd less the total of permanent customer ISGs (161.92 mgd).

b Actual demands are equivalent to purchases as reported in customer billing data.

c Wholesale Customer ISGs are shown in lieu of purchase request projections, which are shown in Table 4-3.

d The City of Brisbane and Guadalupe Valley Municipal Improvement District are two Wholesale Customers that are jointly operated.

e No contractual obligations are shown for the Cities of San Jose and Santa Clara, as they do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the WSA.

f Cordilleras MWC is not a member of BAWSCA or a party to the WSA, and therefore does not have an ISG. Cordilleras MWC has a water supply contract with the SFPUC for 3,007 CCF annually (about 0.006 mgd).

Note: Groveland CSD is not accounted for as a wholesale customer for the purpose of this table and subsequent wholesale supply and demand comparisons. Refer to Table 4-1 for Groveland CSD's current and projected demands. However, in the corresponding standardized tables in Appendix B, Groveland CSD is reported as wholesale rather than retail.

SECTION 5: RETAIL BASELINES AND TARGETS

With the adoption of the Water Conservation Act of 2009, also known as SB X7-7, the State was required to set a goal of reducing urban water use by 20% by the year 2020. Each retail urban water supplier was required to determine its baseline water use, expressed in gallons per capita per day (GPCD) during its baseline period, as well as its target water use for the years 2015 and 2020 in order to help the State achieve the 20% reduction.

In its 2010 UWMP, the SFPUC first established the baseline per capita water use, as well as the interim (i.e. 2015) and 2020 water use targets. In the 2015 UWMP, the SFPUC performed a detailed analysis to update the baselines and targets per capitas based on in-City retail service area population and water use, by (1) revising the population of the in-City retail service area to reflect the 2010 U.S. Census rather than the 2000 U.S. Census, and (2) including the population and water use of the suburban retail service area. The narrative of the 2015 baseline and targets analysis and the SB X7-7 2020 Compliance Form tables are included in Appendix D. This section provides a summary of the 2015 analysis and shows the SFPUC's compliance with the 2020 target.

Additionally, Groveland CSD is not included in this section, as explained in Section 2.4.

5.1 GROSS PER CAPITA WATER USE BASELINES & TARGETS SUMMARY

As described in DWR's *Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009)*, the SFPUC calculated its per capita urban retail water use five-year baseline, 10-year baseline, 2015 interim target and 2020 compliance target in compliance with the Water Conservation Act of 2009. The SFPUC used Method 3 of the four approved methods provided by the Water Conservation Act of 2009 for determining urban water use targets, and adjusted them to meet the minimum water use reduction requirement, of 95% of the five-year baseline. Table 5-1 includes a summary of the baselines and targets calculated in the 2015 UWMP.

Table 5-1. Gross Per Capita Water Use Baselines and Targets Summary (GPCD)

[Standardized Table 5-1: Baselines and Targets Summary]

Baseline Period	Start Year	End Year	Average Baseline	Interim 2015 Target	Confirmed 2020 Target
10–Year Baseline	2001	2010	107	102	96
Five-Year Baseline	2006	2010	101	—	—

5.2 COMPLIANCE WITH 2020 DAILY PER CAPITA WATER USE TARGET

The 2020 gross water use includes the water from the RWS and the groundwater sources supplied by SFPUC to the In-city and suburban retail customers. No deductions for indirect recycled water, agricultural water use or process water was applied. All water sources are metered and meters are calibrated on an annual basis. Note that water use reflects gross water use (i.e., water use by all sectors, including water loss).

The 2020 service area population includes In-City population and suburban retail population. For the in-City retail service area, population data were obtained from the California Department of Finance for the County of San Francisco. However, the same method could not be used for the suburban retail service area since the service area does not align with municipal boundaries. The population estimates for the connections in Redwood City, Daly City, Fremont and Millbrae were calculated using persons-per-household data. Therefore, the SFPUC consulted with DWR (i.e., pre-review) on an appropriate, alternate methodology based on U.S. Census data at the census block level and persons-per-household data. Use of persons-per-household data was deemed adequate since it is assumed that all residential accounts serve single family homes in the suburban retail service area, and no multi-family residences are served. Therefore, the number of connections can be considered equivalent to number of households. For the Town of Sunol specifically, the SFPUC used the web-based DWR Population Tool since the corresponding service area was difficult to define at the census block level (output provided in Appendix H).

The base daily per capita water use was calculated by dividing the annual gross water use by population and averaging the value per day.

As shown in Error! Reference source not found., with a 2020 per capita water use of 76 GPCD, the SFPUC is in compliance with its 2020 target of 96 GPCD. No adjustments were needed.

Table 5-2. Gross Per Capita Water Use Baselines and Targets Summary (GPCD)

[SB X7-7 2020 Compliance Form Table 5: 2020 Gallons Per Capita Per Day (GPCD)]

2020 Gross Water Use (mgd)	2020 Service Area Population	2020 Daily Per Capita Water Use (GPCD)
68.5	899,732	76

Taking into consideration the impact of population and employment growth, as well as passive and active conservation efforts, the SFPUC initially projected in 2015 that its 2020 daily per capita water use would be approximately 86 GPCD. With its continued water conservation program, the SFPUC has achieved a lower than initially predicted per capita water use with a 2020 per capita water use of 76 GPCD, in compliance with the final 2020 target of 96 GPCD.

5.3 ASSISTANCE TO WHOLESALE CUSTOMERS

As a wholesale supplier, the SFPUC is required to provide an assessment of present and proposed future measures, programs, and policies that will help the retail water suppliers in their wholesale service area to achieve their water use reduction targets. This is further discussed in Section 10.3.

SECTION 6: SYSTEM SUPPLIES

This section describes current and projected water supplies, as well as the various sources of supplies available to meet retail and wholesale water demands. Potential recycled water uses and supply availability are addressed. This section also summarizes the options used, or being considered, by the SFPUC to maximize resources and minimize the need to import water from the RWS watersheds.

As explained in Section 2.4, Groveland CSD is accounted for as a retail customer in this section, but as a wholesale customer in the corresponding standardized tables in Appendix B.

6.1 RWS SUPPLIES FOR RETAIL AND WHOLESALE CUSTOMERS

The SFPUC serves its retail and wholesale customers through the integrated operation of local Bay Area water production facilities and the Hetch Hetchy System. The local watershed facilities are operated to conserve local runoff for delivery and to maintain enough stored water to meet demands in the event of an emergency that affects the supply of water from Hetch Hetchy. Demands that are not met by local runoff are met with water diverted from the Tuolumne River through the Hetch Hetchy System. On average, the Hetch Hetchy System provides approximately 85% of the water delivered by the SFPUC. During dry years, the water received from the Hetch Hetchy System can amount to over 90% of the total water delivered.

The amount of water available to the SFPUC is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC depends on reservoir storage to maximize the reliability of its water supplies. More importantly, reservoir storage provides water supply carry-over capability. During dry years, a very small share of the Tuolumne River supply is available to the SFPUC and the local watersheds produce very little water. Reservoir storage is critical during drought cycles because it enables the SFPUC to carry over water supply from wet years to dry years.

As discussed further in Section 7.1, deliveries from the RWS to both retail and wholesale customers are limited by the WSIP Phased Variant adopted by the Commission to an average annual of 265 mgd from the watersheds. The allocation between wholesale and retail customers is described in the Water Supply Agreement. It provides for 184 mgd to the Wholesale Customers consistent with the Supply Assurance and 81 mgd to the retail customers. Although SFPUC can take up to 265 mgd annual average from the RWS, for the purposes of the tables in this section and those in Chapter 8, supplies shown will be those projected to be utilized by the retail and wholesale customers. Given that the SFPUC has a Level of Service objective, based on its contractual obligations to its Wholesale Customers, to provide 265 mgd in normal years, an analysis of our ability to meet this objective in normal, single dry, and multiple dry years is provided in Appendix J.

6.1.1 Water Rights

The City and County of San Francisco holds both pre-1914 appropriative water rights and post-1914 water rights to store and deliver water from the Tuolumne River and local watersheds. Appropriative water rights allow the holder to divert water from a particular water source without regard to the contiguity of the location of use to the source. These rights are based on seniority and the use of water must be reasonable, beneficial, and not wasteful. In 1914, California established a formal water rights permit system (by the 1913 Water Commission Act) administered by the SWRCB. The SWRCB does not have permitting jurisdiction over pre-1914 appropriative water rights.

With the Raker Act of 1913 (38 Stat. 242), Congress granted San Francisco rights of way for the construction and operation of Hetch Hetchy facilities, which are predominantly located on federally owned land in Yosemite National Park and Stanislaus National Forest. The Raker Act recognized the senior water rights of Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) to divert water from the Tuolumne River, and specified conditions for the release of water to the Districts and other conditions imposed by Congress for the protection of recreation in Yosemite and other purposes.

Under Raker Act Section 9(c) and the subsequent Fourth Agreement between San Francisco and the Districts, the Districts are entitled to the natural flow of the Tuolumne River (2,416 cubic feet per second [cfs] between June 13 and April 15 of each year and 4,066 cfs between April 15 and June 13, the spring snowmelt period). These flows are computed on a daily basis based on unimpaired conditions at La Grange Dam below Don Pedro. During multiple drought years, the SFPUC's water diversions from the Tuolumne River may be limited to previously stored (carry-over) water in system reservoirs and the water bank account in Don Pedro reservoir.[8]

6.1.2 Water Quality of RWS Supplies

As described in Section 3.1, the RWS delivers high-quality water. The current surface water supplies available to the RWS include the Tuolumne River and supplies from local Bay Area reservoirs. The majority of the water supply originates in the upper Tuolumne River watershed high in the Sierra Nevada, remote from human development and pollution. This water from the Hetch Hetchy reservoir is protected in pipes and tunnels as it is conveyed to the Bay Area, requiring only primary disinfection and pH adjustment to control corrosion in the pipelines. In addition, this water undergoes UV disinfection at the Tesla Treatment Facility, further ensuring high water quality.

The USEPA and SWRCB DDW have approved the use of this drinking water source without requiring filtration at a treatment plant. However, local water from the local watersheds requires filtration to meet drinking water quality requirements. The filtered and treated water from the local watersheds is blended with water from the Hetch Hetchy reservoir, and most customers receive this blended water supply. System water quality, including both raw water and treated water, is continuously monitored and tested to assure that water delivered to customers meets or exceeds federal and State drinking water and public health requirements.

The SFPUC will continue to rely on these high-quality water sources. No degradation of water quality is anticipated in the future.

The SFPUC prepares an annual water quality report (i.e., Consumer Confidence Report) for its customers each spring, which is available at **www.sfpuc.org/accounts-services/water-quality/annual-water-quality-reports**.

6.1.3 Climate Change Impacts to RWS Supplies

Climate change has become an important factor in water resources planning in the State and is frequently considered in urban water management planning, although the extent and precise effects of climate change remain uncertain. There is convincing evidence that increasing concentrations of greenhouse gases have caused and will continue to cause a rise in temperatures around the world, which will result in a wide range of changes in climate patterns. Moreover, observational data shows that a warming trend occurred during the latter part of the 20th century and will likely continue through the 21st century. These changes will have a direct effect on water resources in California, and numerous studies have been conducted to determine the potential impacts to water resources. Based on these studies, climate change could result in the following types of water resource impacts, some of which are likely to affect the Tuolumne River watershed and local watersheds in the Bay Area:

- Reductions in the average Sierra Nevada annual snowpack due to a rise in the snowline elevation and a shallower snowpack at lower elevations, and a shift in snowmelt runoff to earlier in the year;

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[8] The Districts have senior water rights to the City for the Tuolumne River water and are provided to the first increment of flow in the Upper Tuolumne River watershed according to the apportionment set forth in the Raker Act of 1913. The water bank at Don Pedro Reservoir provides a credit and debit system which allows the City to divert water upstream while meeting its obligations to the Districts. Through this mechanism the SFPUC may pre-deliver the Districts entitlements and credit the water bank so that at other times the SFPUC may retain water upstream while the Districts debit the water bank.

- Changes in the timing, annual average, intensity, and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow;
- Long-term changes in watershed vegetation and increased incidence of wildfires that could affect water quantity and quality;
- Sea level rise and an increase in saltwater intrusion;
- Increased water temperatures with accompanying potential adverse effects on some fisheries and water quality;
- Increases in evaporation and concomitant increased irrigation need; and
- Changes in urban and agricultural water demand.

Both the SFPUC and BAWSCA participated in the 2019 update of the Bay Area Integrated Regional Water Management Plan (BAIRWMP), which includes an assessment of the potential climate change vulnerabilities of the region's water resources and identifies climate change adaptation strategies. In addition, the SFPUC has studied and continues to study the effects of climate change on the RWS. These works are summarized below.

6.1.3.1 Bay Area Integrated Regional Water Management Plan

Climate change adaptation was established as an overarching theme for the 2019 BAIRWMP update. As stated in the BAIRWMP, identification of watershed characteristics that could potentially be vulnerable to future climate change is the first step in assessing vulnerabilities of water resources in the Bay Area Region (Region). Vulnerability is defined as the degree to which a system is exposed to, susceptible to, and able to cope with or adjust to, the adverse effects of climate change. A vulnerability assessment was conducted in accordance with the DWR's *Climate Change Handbook for Regional Water Planning* and using the most current science available for the Region. The vulnerability assessment provides the main water planning categories applicable to the Region—including demand, supply, and water quality, ecosystems and habitat, and sea-level rise—and a general overview of the qualitative assessment of each category with respect to anticipated climate change impacts.

6.1.3.2 SFPUC Climate Change Studies

The SFPUC views assessment of the effects of climate change as an ongoing project requiring regular updating to reflect improvements in climate science, atmospheric/ocean modeling, and human response to the threat of greenhouse gas emissions. Climate change research by the SFPUC began in 2009 and continues to be refined. In its 2012 report "Sensitivity of Upper Tuolumne River Flow to Climate Change Scenarios," the SFPUC assessed the sensitivity of runoff into Hetch Hetchy Reservoir to a range of changes in temperature and precipitation due to climate change. Key conclusions from the report include the following:

- With differing increases in temperature alone, the median annual runoff at Hetch Hetchy would decrease by 0.7-2.1% from present-day conditions by 2040 and by 2.6-10.2% from present-day conditions by 2100. Adding differing decreases in precipitation on top of temperature increases, the median annual runoff at Hetch Hetchy would decrease by 7.6-8.6% from present-day conditions by 2040 and by 24.7-29.4% from present-day conditions by 2100.
- In critically dry years, these reductions in annual runoff at Hetch Hetchy would be significantly greater, with runoff decreasing up to 46.5% from present day conditions by 2100 utilizing the same climate change scenarios.
- In addition to the total change in runoff, there will be a shift in the annual distribution of runoff. Winter and early spring runoff would increase, and late spring and summer runoff would decrease.
- Under all scenarios, snow accumulation would be reduced and snow would melt earlier in the spring, with significant reductions in maximum peak snow water equivalent under most scenarios.

Currently, the SFPUC is conducting a Long-term Vulnerability Assessment which assesses the potential effects of climate change on water supply using a wide range of plausible increases in temperature and changes in precipitation to address the wide uncertainty in climate projections over the planning horizon 2020 to 2070. There are many uncertain factors such as climate change, changing regulations, water quality, growth and economic cycles that may create vulnerabilities for the RWS's ability to meet levels of service. The uncertainties associated with the degree to which these factors will occur and how much risk they present to the water system are difficult to predict, but nonetheless they need to be considered in SFPUC planning. To address this planning challenge, the assessment uses a vulnerability-based planning approach to explore a range of future conditions to identify vulnerabilities, and to assess the risks associated with these vulnerabilities, that could lead to developing an adaptation plan that is flexible and robust to a wide range of future outcomes. This study is expected to be completed in the Summer of 2021.

6.1.4 Summary of Existing and Future RWS Supplies

As discussed further in Section 7.1, deliveries from the RWS to both retail and wholesale customers are limited by the WSIP Phased Variant adopted by the Commission to an average annual of 265 mgd for the watersheds. The allocation between wholesale and retail customers is described in the Water Supply Agreement. It provides for 184 mgd to the Wholesale Customers consistent with the Supply Assurance and 81 mgd to the retail customers. Current and projected supplies from the RWS that are anticipated to be utilized in normal years for both retail and wholesale customers are shown in Table 6-1.

Table 6-1. Regional Water System Supplies Utilized in Normal Years (mgd)

[Standardized Table 6-9 Retail: Water Supplies – Projected]

[Standardized Table 6-9 Wholesale: Water Supplies – Projected]

RWS Supply	Actual	Projected				
	2020	2025	2030	2035	2040	2045
Retail Customers[a, b]	66.5	67.2	67.5	68.6	70.5	73.7
Wholesale Customers[c, d, e]	132.1	146.0	147.9	151.9	156.3	162.8
Total RWS Supplies	198.6	213.2	215.4	220.5	226.8	236.5

[a] Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.

[b] Groveland CSD is reported as a wholesale customer for the purposes of this 2020 UWMP, but it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Its demands would be met by the retail supply allocation of 81 mgd.

[c] Projected RWS supplies to be used by Wholesale Customers are based on the purchase request projections provided to the SFPUC by BAWSCA in January 2021. These purchase requests are subject to change in each individual agency's UWMP.

[d] Projected Wholesale Customer deliveries are limited to 184 mgd. 184 mgd includes the demands of the Cities of San Jose and Santa Clara, which are supplied on a temporary and interruptible basis, with their total supply not exceeding 9 mgd assuming supply is available (decision to be made by end of 2028).

[e] Cordilleras MWC is not a party to the WSA, and it is not included in the wholesale supply allocation of 184 mgd. The demands of Cordilleras MWC are minor (projected to be less than 0.01 mgd) and are anticipated to be met with RWS supplies through 2045.

6.2 LOCAL SUPPLIES FOR RETAIL CUSTOMERS

The RWS comprises about 97% of total retail water supplies, while the remaining portion is from locally produced groundwater, recycled water, and non-potable water. These local supplies are described in the following sections.

6.2.1 Existing Local Supplies

Existing supplies of groundwater, recycled water, and non-potable water are described below. Future supplies are described in Section 6.2.2.

6.2.1.1 Local Groundwater and the San Francisco Groundwater Supply Project

San Francisco overlies all or part of seven un-adjudicated groundwater basins. These groundwater basins include the Westside, Lobos, Marina, Downtown, Islais Valley, South San Francisco, and Visitacion Valley basins. The Lobos, Marina, Downtown, and South San Francisco basins are located wholly within City limits, while the remaining three extend south into San Mateo County. The portion of the Westside Basin aquifer located within the City is referred to as the North Westside Groundwater Basin (or North Westside Basin). With the exception of the Westside and Lobos basins, the basins are generally inadequate to supply groundwater for municipal supply due to low yield, contamination, or potential subsidence concerns.

Early in its history, the City made use of local groundwater, springs, and spring-fed surface water ranging from approximately 6.0 to 8.5 mgd prior to 1934. After imports of water from the Hetch Hetchy Reservoir began in October 1934, municipal supplies began to rely almost exclusively on surface water from the RWS. Local groundwater use, however, has continued in the City. In addition, groundwater has been used and continues to be used in the suburban retail service area.

The local groundwater basins are described below.

Westside Groundwater Basin. With an area of about 40 square miles, the Westside Groundwater Basin is the largest groundwater basin in San Francisco and is currently used to meet water demands for both irrigation and municipal uses. The Westside Groundwater Basin is separated from the Lobos Basin to the north by a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. San Bruno Mountain and San Francisco Bay form the eastern boundary, and the San Andreas Fault and Pacific Ocean form the western boundary. The southern limit of the Westside Groundwater Basin is defined by a bedrock high that separates it from the San Mateo Plain Groundwater Basin. The basin opens to the Pacific Ocean on the northwest and San Francisco Bay on the southeast. The Westside Groundwater Basin contains three relatively distinct aquifer zones referred to as the Shallow Aquifer, Primary Production Aquifer, and Deep Aquifer. The clayey aquitards that separate these aquifers become discontinuous or absent north of Lake Merced. The basin has not been adjudicated nor has it been identified by DWR as overdrafted, or as projected to be overdrafted in the future.

The Westside Groundwater Basin is subdivided for management purposes into northern and southern portions by the county line separating San Francisco and San Mateo Counties. The county-line boundary between the North and South Westside Groundwater Basins does not have hydrogeological significance other than influencing the jurisdictional distribution of groundwater pumping. No geologic features restrict groundwater flow between the northern and southern parts of the groundwater basin.

Within San Mateo County, the South Westside Groundwater Basin (or South Westside Basin) encompasses 25 square miles and extends southeast across the San Francisco Peninsula south of San Bruno Mountain from the ocean near Daly City to San Francisco Bay in Burlingame. It is described in the South Westside Basin Groundwater Management Plan.[9] Municipal water demand within the South Westside Basin is served by the City of San Bruno, California Water Service Company, City of Daly City, and the SFPUC as a wholesaler to those entities.

The North Westside Basin has a land surface area of 15 square miles encompassing much of the western third of the City, including Lake Merced and most of Golden Gate Park. The North Westside Basin is largely residential, with residential and

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[9] City of San Bruno, California Water Service Company, Daly City, and Hetch Hetchy Regional Water System. 2012. *South Westside Basin Groundwater Management Plan*.

commercial land uses accounting for about 75%, including the Sunset and Parkside districts; and at least 25% park and open space, most notably Golden Gate Park, Lake Merced, golf clubs, and hilltop parks along the basin's eastern boundary. The North Westside Basin land surface extends from sea level along Ocean Beach to nearly 1,000 feet above sea level along a bedrock ridge three to four miles inland. The North Westside Basin is bounded on the north by a mostly buried bedrock ridge extending from Point Lobos southeast through Golden Gate Park and northeast through Lone Mountain. The basin boundary encompasses the panhandle of Golden Gate Park, then extends south-southwest through Twin Peaks and Mount Davidson, crossing south into San Mateo County a little more than a mile east of Lake Merced. The San Andreas Fault Zone trends offshore to the northwest of Daly City and is interpreted to bound the basin on the west. Existing retail groundwater sources are pumped from the North Westside Basin.

The SFPUC leads the basin-wide Westside Basin Groundwater Monitoring Program. It provides information summarizing groundwater pumping, groundwater levels, and groundwater quality, along with Lake Merced water elevations. This program publishes an annual monitoring report, which may be accessed at **www.sfpuc.org/programs/water-supply-planning/groundwater**. Monitoring in the North Westside Basin is accomplished by wells constructed in either single, nested, or clustered configurations at approximately 21 locations. Groundwater levels in all wells are measured quarterly by hand and supplemented by continuous monitoring using pressure transducers at select locations. Based on regular groundwater monitoring conducted in the North Westside Basin since 2004, static groundwater levels along the Pacific Coast and north of Lake Merced have generally remained above sea level in the Shallow and Primary Production Aquifers.

Within the City, the SFPUC samples groundwater at 13 monitoring well locations semiannually to monitor general water quality in the groundwater basin, including locations in Golden Gate Park, coastal wells located in the vicinity of the Great Highway, lake-aquifer monitoring wells in the vicinity of Lake Merced, and one at the West Sunset Playground. The monitored parameters include total alkalinity, calcium, magnesium, sodium, potassium, bicarbonate, hardness, chloride, nitrate, sulfate, TDS, pH, and specific conductance.

Since 1872, groundwater has been pumped from wells located in Golden Gate Park, and by the San Francisco Zoo since the 1930s. Based on flow meter data, about 1.5 mgd is produced by these wells on an average annual basis. The groundwater is mostly used by the San Francisco Recreation and Parks Department for irrigation and other non-potable uses (e.g., lake filling, water exhibits) at Golden Gate Park, the San Francisco Zoo, and landscaped medians along the Great Highway.

The San Francisco Groundwater Supply Project (SFGW) constructed or rehabilitated six groundwater supply wells and their associated pump stations, and more than five miles of pipelines to distribute groundwater to in-City reservoirs for blending with the municipal drinking water supply. Construction began in 2014 and was completed in 2020. These wells pump groundwater from 120 to 460 feet below ground within the San Francisco portion of the Westside Basin. Before entering the in-City distribution system, the pumped groundwater is disinfected and then blended in relatively small quantities in Sunset and Sutro Reservoirs with water supplied by the RWS. During calendar year 2020, the SFGW wells supplied an average of 0.5 mgd to the reservoirs. Once the Westside Recycled Water Project is completed and the project's wells in Golden Gate Park are no longer needed for irrigation, the project will add an average of up to 1 mgd to the local water system for one or more years. Over the following several years, with continued monitoring and testing, production will step up to an average of 4 mgd. Given approximately 1.3 mgd of existing groundwater use for irrigation, this project represents approximately 2.7 mgd of net new supply. Two of the six wells are capable of serving as emergency drinking water supplies following an earthquake or other natural disaster, and include filling stations for emergency water tankers.

The SFPUC developed a draft Groundwater Management Plan (GMP) for the North Westside Basin in 2005 in response to the 1992 California Groundwater Management Act (AB 3030). Following passage of the 2014 California Sustainable Groundwater Management Act (SGMA), the SFPUC established itself in March 2015 as the Groundwater Sustainability Agency (GSA) for all of San Francisco. The SFPUC then completed a draft Groundwater Sustainability Plan (GSP) for the North Westside Basin in 2016. This plan has guided the implementation of the SFGW Project to ensure sustainable groundwater management in the northern portion of the Basin. The plan summarizes the Basin hydrogeology and defines measurable objectives and actions for protecting groundwater yield and quality, such as avoiding salt water intrusion, land subsidence, and impacts to interconnected surface water resources. Because DWR designated the Westside Basin and San Francisco's other groundwater basins as very low priority in early 2019, the SFPUC is not required to submit a GSP to the State, but will sustainably manage the northern portion of the Westside Basin consistent with SGMA. Currently, the SFPUC is updating the 2016 plan and will finalize it as a GMP under AB 3030. Adherence to this plan will ensure a long-term, high quality, local water supply for current and future uses.

Livermore Valley Basin, Central Groundwater Sub Basin. In the suburban retail service area, about 0.4 mgd of groundwater is delivered to the Castlewood CSA from the Castlewood Well System operated by the SFPUC (this system is described in Section 3.1.5.2). Groundwater is drawn from the Central Groundwater Sub Basin in the Livermore Valley Basin. DWR has not identified this basin as overdrafted, nor as projected to be overdrafted in the future. These wells are metered and have been in operation for several decades. The system serving Castlewood is not connected to the RWS.

The volumes of groundwater pumped between 2016 and 2020 from the three sources described above are shown in Table 6-2.

Table 6-2. Groundwater Pumped (mgd)

[Standardized Table 6-1 Retail: Groundwater Volume Pumped]

Groundwater Source	2016	2017	2018	2019	2020
Westside Groundwater Basin[a]	1.2	1.3	1.7	1.7	2.0
Livermore Valley Basin, Central Groundwater Sub Basin[b]	0.4	0.4	0.3	0.4	0.3

a Data from 2016-2019 are obtained from the 2019 Annual Groundwater Monitoring Report, Westside Basin (SFPUC, April 2020), 2020 data are from verbal communications with SFPUC groundwater staff. Pumping volumes are reported on a calendar year basis, but are used to approximate fiscal year data for this table.

b This basin is the source of water for the Castlewood Well System. Pumping volumes are assumed to be equivalent to billed consumption for Castlewood CSA; obtained from customer billing data.

6.2.1.2 Other Surface Water

The Sunol Filter Gallery (Gallery) is located adjacent to Alameda Creek in Sunol, south of the SFPUC's Sunol Pump Station. The supplies are from subsurface flows directly tied to flow in the creek and creek bed. As such, it is considered to be surface water and is subject to surface water permitting. This supply source provided approximately 0.3 mgd of water for irrigation purposes to the Sunol Valley Golf Club until January 2016, when the golf course ceased operating and thus the source production was substantially reduced. Since 2016, the Gallery diversions from Alameda Creek have been limited to maintenance water supply and emergency fire water for the golf course property. The SFPUC is currently evaluating options to make the Sunol Filter Gallery fully operational and use the source to its full capacity

6.2.1.3 Local Recycled Water

From 1932 to 1981, the City's McQueen Treatment Plant provided recycled water to Golden Gate Park for irrigation and flow augmentation of its streams and lakes. Due to changes in State regulations, the plant could no longer meet required standards. Subsequently, the City closed the McQueen Treatment Plant and discontinued the use of recycled water in Golden Gate Park; however, a limited volume of recycled water is currently used in the retail service area as described below.

Southeast Water Pollution Control Plant. Disinfected secondary-treated recycled water from the Southeast WPCP was provided to construction contractors, City departments, and other interested parties for use within the City via the truck-fill station through 2015. The facility has not been operational since 2015. The SFPUC is exploring resuming recycled water production dedicated to onsite uses at the plant.

Harding Park. The Harding Park Recycled Water Project, a partnership between the SFPUC and NSMCSD, was completed in October 2012 and provides tertiary-treated recycled water for irrigating the Harding Park and Fleming Golf Courses in San Francisco. The project replaces the use of potable water from the RWS for golf course irrigation and has an average capacity of 0.23 mgd. However, in 2020, the system was offline for most of the year due to infrastructure upgrades. The system therefore supplied approximately 5 MG (0.01 mgd) to Harding Park, a retail customer of the SFPUC.

Sharp Park. The Pacifica Recycled Water Project provides recycled water to several irrigation customers in Pacifica including a portion of the Sharp Park Golf Course, a retail customer of the SFPUC. This project was developed and constructed through a partnership between the SFPUC and NCCWD. An automated irrigation system was installed on the east side of the golf course, and recycled water delivery began in October 2014. In 2020, the Sharp Park operation was fully online and recycled water deliveries were estimated to be 0.1 mgd.

Projections of recycled water use in the retail service area were provided in the 2015 UWMP. At that time, it was estimated that 0.3 mgd of recycled water would be used in 2020. Actual use in 2020 was approximately 0.1 mgd, since the Harding Park Recycled Water Project was offline during most of 2020. A comparison of projected and actual recycled water uses is shown in Table 6-3.

Table 6-3. Projected and Actual Recycled Water Use for 2020 (mgd)

[Standardized Table 6-5 Retail: 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual]

Use Type	2015 Projection for 2020	Actual Use in 2020
Golf Course Irrigation[a]	0.3	0.1
a Golf course irrigation includes Harding Park, Fleming and Sharp Park golf courses.		

6.2.1.4 Wastewater Assessment

The SFPUC's Wastewater Enterprise operates the City's wastewater collection, treatment, and disposal system, which consists of a combined sewer system (which collects both sewage and stormwater), three water pollution control plants, and outfalls to San Francisco Bay and the Pacific Ocean. The collection and conveyance system consists of over 900 miles of various sizes of underground sewer pipes, transport/storage structures, and pump stations located throughout the City. The Southeast WPCP and Oceanside WPCP provide secondary treatment and operate year-round; while the North Point Wet Weather Facility operates only during wet weather and provides primary treatment. Ultimate disposal of treated wastewater effluent is currently through outfalls to both San Francisco Bay and the Pacific Ocean. The Treasure Island Wastewater Treatment Plant provides secondary treatment of domestic and commercial wastewater from Treasure Island and Yerba Buena Island, located in the San Francisco Bay. The plant's effluent is discharged to Central San Francisco Bay. The Mel Leong Treatment Plan is located at the San Francisco International Airport and treats domestic and industrial wastewater from the airport facilities. The plant's effluent is eventually discharged to the Lower San Francisco Bay[10]. Table 6-4 summarizes the current volumes of wastewater collected, treated and discharged within the retail service area.

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[10] The effluent of the Mel Leong Treatment Plant is discharged to the North Bayside System Unit forcemain, which conveys the treated wastewater to dechlorination facilities prior to its discharge to the Lower San Francisco Bay.

As mentioned previously, suburban retail water use in 2020 was 3.5 mgd, which was about 5% of total retail demand. As such, the volume of wastewater generated within the SFPUC's suburban water retail service area is assumed to be small compared to in-City wastewater generation. However, notable large suburban retail customers are included in Table 6-4.

Table 6-4. Wastewater Operations within Retail Service Area

[Standardized Table 6-2 Retail: Wastewater Collected Within Service Area]

[Standardized Table 6-3 Retail: Wastewater Treatment and Discharge Within Service Area in 2020]

Treatment Plant	Operator	Location	Volume of Wastewater in 2020 (mgd)				Recycled Water Delivered within Retail Service Area in 2020 (mgd)
			Collected	Treated (Level)	Discharged	Recycled	
Southeast WPCP[a,b]	SFPUC	San Francisco	56.2	56.2 (secondary, disinfected)	52.1[c]	0	0
Oceanside WPCP[b]	SFPUC	San Francisco	14.5	14.5 (secondary, undisinfected)	15.0[d]	0	0
Treasure Island Wastewater Treatment Plant	US Navy and Treasure Island Development Authority	Treasure Island	0.33	0.33 (secondary disinfected)	0.30	0	0
Mel Leong Treatment Plant[e,f,]	City and County of San Francisco	San Francisco International Airport	0.38	0.38 (secondary, disinfected)	0.38	0	0

a The Southeast Water Pollution Control Plant (WPCP) and North Point Wet Weather Facility are grouped together as one facility because they are hydraulically connected (both plants receive influent from the same collection system) and their discharges are covered by the same permit.

b At the Southeast and Oceanside WPCPs, metered effluent flows include both primary-only and secondary treated effluent (the bulk of which is secondary treated) and flows include treated combined wastewater and stormwater because the collection systems are predominantly combined systems.

c The volume discharged is less than the volume collected because a small volume of the discharged wastewater is treated to secondary, disinfected-23 level and used for other purposes.

d The volume discharged is higher than the volume collected because the discharged volume includes additional plant recycle streams.

e The Mel Leong Treatment Plant is the only wastewater facility that treats and discharges wastewater generated by a suburban retail water customer within the suburban retail service area. Wastewater utilities serving other suburban retail customers do not treat or dispose of wastewater within the suburban retail service area.

f Volumes of wastewater treated at and discharged from the Mel Leong Treatment Plant correspond to calendar year 2020.

6.2.2 Future Local Supplies

The SFPUC anticipates that the existing local supplies described above will be available in the future. However, to reliably and sustainably meet the future water needs of its retail customers, the SFPUC is supplementing and diversifying its water supply portfolio through the further development of local water supplies, such as increasing groundwater and recycled water production. These projects are critical to reducing impacts associated with any one supply being disrupted, reduced, or interrupted. Projects related to these efforts are described below, and projected volumes are later provided in Table 6-5. Additional water supply projects being developed under the new Alternative Water Supply Program are described in Section 7-4.

6.2.2.1 Westside Recycled Water Project

The Westside Recycled Water Project includes construction of a tertiary recycled water plant and associated pipelines to replace RWS and groundwater supplies currently used to irrigate Golden Gate Park, Lincoln Park and Golf Course, the

San Francisco Zoo, and the Presidio Golf Course, as well as other landscaping in the Presidio. The plant is currently under construction on the west side of the City at the Oceanside WPCP. For planning purposes, deliveries from the Westside project are estimated to be 1.6 mgd in 2025 and 1.8 mgd in 2030 and beyond. The project is designed to deliver an annual average of up to 2 mgd.

The project Environmental Impact Report (EIR) was certified by the San Francisco Planning Commission and approved by the SFPUC's Commission in September 2015. The construction of the recycled water pipeline began in early 2017 and was completed in July 2018. The treatment facility and pump station are currently under construction, which began in late 2017 and mid-2019, respectively. Work is currently underway to retrofit the irrigation systems in Golden Gate Park and Lincoln Park and bring them into compliance with California recycled water regulations.

The SFPUC is currently in the early design phase of the San Francisco Zoo Recycled Water Project, which will extend recycled water service from the Westside Recycled Water Treatment Facility to the San Francisco Zoo. The recycled water pipeline that currently extends from the RWTF to Golden Gate Park includes a turnout to the Zoo. Extending a new pipeline from the turnout to the non-potable reservoir on Zoo grounds will allow RPD to switch from groundwater to recycled water to meet the Zoo's non-potable water demands, while supporting groundwater management goals for the Westside groundwater basin.

Recycled water deliveries to Golden Gate Park and Lincoln Park (annual average of 1.3 mgd) are expected to begin in early 2022. Deliveries to the San Francisco Zoo (annual average of 0.3 mgd) are expected to begin in 2023. SFPUC is also currently planning for deliveries to the Presidio (annual average of 0.2 mgd) beginning by 2030.

6.2.2.2 Treasure Island Recycled Water Project

The Treasure Island Water Resource Recovery Facility (TIWRRF) will be located on the northeast corner of Treasure Island (TI) in San Francisco, California on a geotechnically improved "greenfield" site of approximately 10 acres. The TIWRRF will provide tertiary wastewater treatment and wetlands to achieve an average dry weather flow (ADWF) capacity of at least 1.3 mgd and peak wet weather flow (PWWF) of 3.9 mgd. The TIWRRF will support the redevelopment of Treasure Island and Yerba Buena Island and the 8,000 new homes currently under construction.

The TIWRRF will include liquid treatment processes, solids handling, odor control, a wetland, and produce Title 22 disinfected tertiary quality of treated wastewater effluent. It is anticipated that the TI development will use an average of 0.4 MGD and a peak of 1.0 MGD of recycled water for uses that include dual plumbing in buildings and outdoor urban agriculture and irrigation. The TIWRRF and associated wetlands are consistent with the open space vision for the Development. Construction is anticipated to start in early to mid-2022 and be completed in early to mid-2024.

6.2.2.3 Other Actions to Expand Recycled Water Use

The SFPUC is actively involved in encouraging and expanding recycled water use and onsite water reuse. These efforts are described below.

Projects and Partnerships. As demonstrated by the Harding Park and Pacifica Recycled Water Projects, the SFPUC has and will continue to explore opportunities for regional recycled water partnerships with other Bay Area agencies. Through these partnerships, the SFPUC aims to develop recycled water projects that will benefit the SFPUC and partners by reducing demands for RWS supplies and/or freeing up groundwater that could be used for potable supplies.

Ordinances, Programs, and Services. The SFPUC administers or helps to administer the following ordinances, programs, and services in the City related to recycled water and water reuse. The majority of these ordinances, programs, and services have been established for many years and are ongoing, resulting in increased water reuse.

- **Recycled Water Program and Ordinance:** To encourage the use of recycled water in San Francisco, the City adopted Ordinances 390-91 and 391-91, collectively referred to as the Recycled Water Ordinance.[11] This ordinance requires the installation of dual-plumbed systems within designated areas of the City for new, remodeled or converted buildings; all subdivisions of 40,000 square feet or more; and for new, modified, or existing irrigated areas of 10,000 square feet or more. The number of dual-plumbed systems installed as required by the ordinance continues to increase with the increase of new construction and rehabilitation projects in the City.

- **Soil Compaction and Dust Control Ordinance:** In 1991, the City also passed Ordinance 175-91[12], which restricts the use of potable water for soil compaction and dust control activities for construction and demolition projects. To facilitate the use of non-potable water for these activities, the SFPUC installed a recycled water truck-fill station at its Southeast WPCP. Construction contractors, City departments, and other interested parties may fill water trucks at the station after receiving a permit from the SFPUC.

- **Large Landscape Grant Program:** The SFPUC initiated a Large Landscape Grant Program in 2009. In-City retail customers with 1/4 acre or more (originally 2.5 acres or more when the program started) of irrigated landscape are eligible to apply. Grant funding is available for water-saving and recycled water retrofits that reduce potable water use for landscape irrigation. The SFPUC also provides technical assistance in implementing retrofits. The recycled water irrigation system retrofits at both Harding Park and Sharp Park received grant funding through this program.

- **Non-potable Water Program and Ordinance:** As described in Section 4.1.4, the City adopted the Non-potable Water Ordinance in 2012 to allow for the collection, treatment, and use of alternate water sources for non-potable applications. The Non-potable Water Program outlines the oversight of the SFPUC, the SFDPH-EH, and the San Francisco Department of Building Inspection (SFDBI) during the review process. The ordinance was amended in 2015 to mandate the installation of onsite water systems in new development meeting specified criteria.

- **Public Outreach:** The SFPUC actively promotes its programs to conserve, diversify, and supplement RWS supplies. Marketing campaigns, factsheets, and articles are developed and shared with media, customers, and public officials.

Research and Knowledge Sharing. The SFPUC is a member of the Bay Area Clean Water Agencies (BACWA) Recycled Water Committee. BACWA is composed of Bay Area wastewater agencies that discharge into the San Francisco Bay estuary. The purpose of the Recycled Water Committee is to provide a forum to share recycled water information and expertise to support and advance regional water recycling efforts. SFPUC is also an active member of the national WateReuse Association and the California Section., SFPUC is also an active member of the Water Research Foundation.. In addition, SFPUC participates on the California Urban Water Association (CUWA) water reuse committee.

6.2.3 Water Quality of Local Supplies

Local groundwater, recycled water, and non-potable water supplies are primarily used for irrigation and other non-potable uses. The SFPUC strives to meet or exceed the quality standards established by State agencies for these end uses, and works closely with regulatory agencies and partners to achieve the highest standards. Water quality of each supply is further described below.

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[11] San Francisco Public Works Code, Article 22, Sections 1200-1210. Note that this ordinance was amended in 1994 by Ordinance 393-94, which expanded the designated recycled water use area to include Treasure Island, Yerba Buena Island, and Hunters Point Shipyard.

[12] San Francisco Public Works Code, Article 21, Sections 1100-1107.

6.2.3.1 Local Groundwater Quality

This section describes the water quality of existing and future groundwater supplies.

Westside Groundwater Basin. Groundwater from the Westside Groundwater Basin has been supplying drinking water to Daly City, San Bruno, and South San Francisco for over 60 years, and in 2017 was incorporated into the drinking water supply for San Francisco. The pumped groundwater is disinfected and blended with RWS supplies before entering the in-City distribution system. Disinfection with sodium hypochlorite and pH adjustment for corrosion control is performed. The quality of the blended water satisfies all health-based drinking water standards set forth by the SWRCB DDW.

As described in Section 6.2.1.1, the SFPUC conducts the Westside Basin Groundwater Monitoring Program. It includes monitoring groundwater quality to provide early warning for potential saltwater intrusion and other potential sources of contamination. The SFPUC will continue to monitor these wells and add additional wells to the network as needed to assess how the basin is responding to SFGW and other related project operations.

Castlewood Well System. Groundwater supplies from the Castlewood Well System are disinfected via sodium hypochlorite injection and are potable when delivered to Castlewood CSA. Water quality is monitored weekly by the SFPUC.

6.2.3.2 Local Recycled Water Quality

This subsection describes the water quality of existing and future recycled water supplies.

Harding Park. Recycled water produced by NSMCSD's wastewater treatment plant in Daly City is used for irrigation at the Harding Park and Fleming Golf Courses. This tertiary-treated recycled water meets the Title 22 California Code of Regulations (Title 22) requirements for approved non-potable uses.

Sharp Park. Recycled water produced by the City of Pacifica's Calera Creek Water Recycling Plant and delivered by NCCWD is used to irrigate a portion of the Sharp Park Golf Course. This tertiary-treated recycled water meets the Title 22 requirements for approved non-potable uses.

Westside Recycled Water Project. Recycled water produced by the Westside Recycled Water Project treatment facility will undergo tertiary treatment, followed by reverse osmosis and UV, resulting in water quality that meets Title 22 requirements and the needs of the project's planned end uses, including irrigation at Golden Gate Park, Lincoln Park and Golf Course, the Presidio Golf Course, and other landscaped areas at the Presidio.

6.2.4 Climate Change Impacts to Local Supplies

The SFPUC's primary concern related to climate change is the potential impact to RWS supplies, as addressed in Section 6.1.3. Implementation of the Groundwater Sustainability Plan for the North Westside Basin will ensure that in-City groundwater supplies are maintained for current and future uses. Recycled water is considered a drought-resistant supply that is not impacted by precipitation or hydrologic year type.

6.2.5 Summary of Existing and Future Local Supplies

Table 6-5 provides a breakdown of current and projected water supply sources for meeting retail water demand through 2045. Up to 81 mgd of RWS supplies are available to retail customers in normal years. The SFPUC is also committed to developing local supplies to meet retail demands; therefore, the SFPUC would use local groundwater and recycled water supplies before using RWS supplies to meet retail demands.

Table 6-5. Retail Supplies (mgd)

[Standardized Table 6-4 Retail: Current and Projected Recycled Water Direct Beneficial uses Within Service Area]

[Standardized Table 6-8 Retail: Water Supplies – Actual]

[Standardized Table 6-9 Retail: Water Supplies – Projected]

Retail Supply	Actual	Projected				
	2020	2025	2030	2035	2040	2045
RWS Supply Utilized by Retail Customers[a]	66.5	67.2	67.5	68.6	70.5	73.7
Groundwater						
In-City Potable [b]	0.4	1.0	2.0	3.0	4.0	4.0
In-City Irrigation[b,c]	1.5	0.0	0.0	0.0	0.0	0.0
Castlewood Well System[d]	0.3	0.4	0.4	0.4	0.4	0.4
Subtotal Groundwater	2.2	1.4	2.4	3.4	4.4	4.4
Recycled Water						
Westside Recycled Water Project[e]	—	1.6	1.8	1.8	1.8	1.8
Harding Park Recycled Water Project[f]	0.0	0.2	0.2	0.2	0.2	0.2
Sharp Park Recycled Water Project[g]	0.1	0.1	0.1	0.1	0.1	0.1
Treasure Island Recycled Water Project[h]	0.0	0.2	0.4	0.4	0.4	0.4
Subtotal Recycled Water	0.1	2.1	2.5	2.5	2.5	2.5
Total Retail Supply	68.8	70.7	72.4	74.5	77.4	80.6

[a] Assuming that the retail supply allocation remains 81 mgd through 2045, up to 81 mgd of RWS supply may be used.

[b] The San Francisco Groundwater Supply Project will ramp up potable water production from 1 mgd in 2025 to 4 mgd by 2030. About 1.5 mgd of groundwater currently serves irrigation at Golden Gate Park, the San Francisco Zoo, and the Great Highway medians. This 1.5 mgd of groundwater will be converted to potable supply under the San Francisco Groundwater Supply Project.

[c] No groundwater will be used for in-city irrigation once the Westside Recycled Water Project comes online.

[d] Castlewood CSA is served by the Castlewood Well System.

[e] The Westside Recycled Water Project will supply Golden Gate Park (1.2 mgd), Lincoln Park (0.1 mgd) and the Zoo (0.3 mgd) by 2025, and the Presidio (0.2 mgd) by 2030.

[f] Irrigation at Harding Park and Fleming Golf Courses is provided recycled water from NSMCSD. The Harding Park Recycled Water Project was not operational in 2020 and is planned to be back online by 2025.

[g] Irrigation at Sharp Park Golf Course is provided recycled water from NCCWD. The Sharp Park Recycled Water Project was fully online in 2020 and approximately 0.1 mgd was provided in 2020.

[h] Recycled water operations will begin in 2025, but the full infrastructure for delivery will not be built out at that time; the full capacity of 0.4 mgd annual average is anticipated to be reached by 2030.

6.3 ENERGY INTENSITY ANALYSIS

As mandated by Section 10631.2(a) of the CWC, energy intensity data for FY19-20 for the SFPUC system is included in the following section and in Appendix I.

Based on the SFPUC's water delivery system, it is not possible to separate the energy data for the retail and wholesale water deliveries. The Total Utility Approach is therefore used to report the system's available energy intensity information. While the total volume of water delivered includes both retail and wholesale usage, SFPUC does not have access to electricity meter records for the electricity usage of its wholesale customers to distribute water within their own service areas, and is therefore not included in this analysis. In addition, the electricity consumed by other entities to produce recycled water is not included.

The reported energy consumed includes the consequential hydropower produced as a result of the water delivery through the RWS. The RWS is almost entirely gravity-driven from its Sierra Reservoirs to the Bay Area; no electricity is used for pumping at wholesale customer turnouts. Electricity usage taken into account in this analysis primarily represents pumping to off-stream storage in the Bay Area, in-city pumping for water distribution, and usage at the SFPUC's two water treatment plants (Sunol and Harry Tracy WTPs). The electricity usage also includes administrative and support facilities. The Hetch Hetchy Regional Power System is composed of three (3) hydroelectric powerhouses, which account for a total hydroelectric generating capacity of 385 MW: Moccasin Powerhouse, Kirkwood Powerhouse and Holm Powerhouse.

SECTION 7: WATER SUPPLY RELIABILITY NARRATIVE

This section describes the reliability of the RWS and local supplies to meet retail and wholesale demands through the year 2045. As described previously, supplies to meet retail demands come from the RWS and local water supply sources, including groundwater and recycled water. Approximately one third of the SFPUC's RWS supply is delivered to retail customers, and the remaining two thirds is delivered to wholesale customers.

Reliability of the RWS is expressed in terms of the system's ability to deliver water during droughts. Reliability may be quantified by the amount and frequency of water delivery reductions (i.e., deficiencies) required to balance customer demands with available supplies. The SFPUC plans deliveries under the premise that a drought more severe than the worst drought on record may occur. This section describes the SFPUC's nearly-completed Water System Improvement Program (WSIP), new and continued factors that are impacting supply reliability, and the SFPUC's new Alternative Water Supply Planning Program whose aim is to address future potential supply shortfalls.

7.1 WATER SYSTEM IMPROVEMENT PROGRAM

The WSIP is a $4.8 billion, multi-year capital program to upgrade the RWS and is approximately 96% complete to date. The SFPUC undertook the WSIP to ensure the ability of the RWS to meet Level of Service (LOS) goals and objectives for water quality, seismic reliability, delivery reliability, and water supply. The Water Supply LOS goal, stated in the WSIP and adopted in 2008, is to meet customer water needs in non-drought and drought periods.

As required under the California Environmental Quality Act (CEQA), the San Francisco Planning Department prepared a Programmatic Environmental Impact Report (PEIR) for the WSIP, which was certified in October 2008. The PEIR evaluated the potential environmental impacts of the proposed WSIP projects and identified potential mitigations to those impacts. The PEIR also evaluated several alternatives to meet the SFPUC service area's projected increase in water demand through 2030. The water supply improvement options that were evaluated included 10 alternatives using various water supply combinations from the local watersheds; the Tuolumne and Lower Tuolumne River; ocean desalination; and additional recycled water, groundwater, and conservation.

The Phased WSIP Variant includes the following water supply elements:

- Cap on RWS deliveries at 265 mgd annual average, referred to as the Interim Supply Limitation (ISL). This includes 184 mgd for the Wholesale Customers and 81 mgd for retail customers.[13]
- Water supply sources include 265 mgd average annual from the RWS and 20 mgd of water conservation[14], recycled water, and local groundwater developed within the SFPUC's service area (10 mgd in the retail service area and 10 mgd in the wholesale service area);
- Water supply projects to meet dry-year demands with no greater than 20% system-wide rationing in any one year. For a discussion of the WSIP dry-year projects and their current status, see section 7.2 below.
- Reevaluation of 2030 demand projections, potential RWS purchase requests, and water supply options by December 31, 2018 and a separate SFPUC decision no later than 2018 regarding RWS future water deliveries after 2018. As discussed further below in Section 7.3.3, this process has been postponed to 2028 to allow for the necessary supply assessments and environmental review.

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[13] As explained in Section 2.4, Groveland CSD is considered a retail customer of the SFPUC. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation of 81 mgd.

[14] Water conservation is accounted for as a demand reduction.

7.2 WSIP DRY-YEAR WATER SUPPLY PROJECTS

The SFPUC undertook a number of water supply projects through WSIP to meet dry-year demands with no greater than 20 percent system-wide rationing in any one year.

Calaveras Dam Replacement Project. Calaveras Dam is located in the East Bay near a seismically active fault zone and was determined to be seismically vulnerable. The SFPUC operated Calaveras Reservoir at 39 percent of its capacity as a result of a California Division of Safety of Dams (DSOD) order from 2001 to 2018. The reduced capacity significantly affected the ability of the SFPUC to carryover dry-year water supplies from one year to the next and, therefore, impacted the SFPUC's dry-year water supplies. To address the dam's vulnerability, the SFPUC constructed a new dam of equal height downstream of the existing dam. Construction of the embankment dam was completed in Fall 2018; at that time, the SFPUC began impounding water behind the new dam in accordance with DSOD guidance. As of December 2020, reservoir storage was at 55% of total capacity. Maximum reservoir storage since refill began was 67% of capacity, in May of 2019. Storage has declined since then due to dry hydrologic conditions. The project reached final completion in July 2019 and has been in the closeout phase since 2019 without the Calaveras Reservoir reaching sufficient level to fulfill Initial Fill Plan inspections. The project team continues to monitor and is ready to resume reservoir initial fill inspections in 2021.

Alameda Creek Recapture Project. The Alameda Creek Recapture Project[15] will recapture the water system yield that is either lost due to instream flow releases at Calaveras Reservoir or bypassed around the Alameda Creek Diversion Dam and return this yield to the RWS through facilities in the Sunol Valley. Water that naturally infiltrates from Alameda Creek will be recaptured into an existing quarry pond known as SMP (Surface Mining Permit)-24 Pond F2. The project will be designed to allow the recaptured water to be pumped to the Sunol Valley Water Treatment Plant or to San Antonio Reservoir. Construction of this project will occur from spring 2021 to spring 2023.

Lower Crystal Springs Dam Improvements Project. The Lower Crystal Springs Dam (LCSD) Improvements Project was completed in May 2012. The related joint San Mateo County/SFPUC Bridge Replacement Project to replace the bridge across the Lower Crystal Springs Dam was completed in January 2019. A WSIP follow up project to modify the LCSD Stilling Basin for fish habitat and upgrade the fish water release and other valves started in April 2019. While the main improvements to the dam have been completed, environmental permitting issues for reservoir operation remain significant. When the reservoir elevation was lowered due to DSOD restrictions, habitat for Fountain Thistle, an endangered plant species, was discovered in areas formerly inundated by the reservoir. Raising the reservoir elevation now requires that new plant populations be reinstated incrementally before the reservoir elevation is restored. The result is that it may be several years before pre-project water storage volumes can be realized.

Regional Groundwater Storage and Recovery Project. The Regional Groundwater Storage and Recovery (GSR) Project is a strategic partnership between the SFPUC and three San Mateo County agencies: the California Water Service Company (serving South San Francisco and Colma), the City of Daly City, and the City of San Bruno. The project sustainably manages groundwater and surface water resources in order to provide the RWS with additional supplies during times of drought. During years of normal or heavy rainfall, the project would provide additional surface water to the partner agencies in San Mateo County, allowing them to reduce the amount of groundwater that they pump from the South Westside Groundwater Basin. Over time, the reduced pumping would allow the aquifer to naturally recharge and result in increased groundwater storage of up to 61,000 acre feet of new water supply available during dry years.

Phase 1 of this project, which includes constructing of thirteen well sites, is over 99 percent complete. Testing of the groundwater delivery system took place in 2020. Construction of Phase 1 is expected to be complete in 2021. Phase 2 of this project consists of completing construction of the well station at the South San Francisco Main site that was delayed due to access restrictions, and also various carryover work at the other well sites that were not completed during Phase 1.

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[15] The project formerly known as the Upper Alameda Creek Filter Gallery Project in the WSIP was later reconfigured as the Alameda Creek Recapture Project.

Phase 2 design work began in early 2020. The 95% design has been completed and submitted to fellow partner agencies for review, and the 100% design package is being drafted.

A new project called "Regional Groundwater Treatment Improvements" was approved in the 10-Year Water Enterprise Capital Improvement Program for FY 2021-2030 and includes treatment facilities for several of the GSR wells to address groundwater quality issues that have emerged since the wells were constructed. This project will be initiated in 2021.

Water Transfers. During the planning and implementation of the Phased WSIP, the SFPUC pursued a long-term agreement to transfer 2 mgd from Modesto irrigation District (MID) to the SFPUC in drought years. Negotiations with MID ended in 2012 when an agreement could not be reached. The dry-year transfer project is now being included as part of the new SFPUC Alternative Water Supply Program and is described in further detail in Section 7.3.9.

7.3 FACTORS AFFECTING FUTURE RWS SUPPLIES

There are several factors that may impact future RWS supplies; these factors are described below.

7.3.1 Adoption of the 2018 Bay-Delta Plan Amendment

In December 2018, the State Water Resources Control Board (SWRCB) adopted amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) to establish water quality objectives to maintain the health of the Bay-Delta ecosystem. The SWRCB is required by law to regularly review this plan. The adopted Bay-Delta Plan Amendment was developed with the stated goal of increasing salmonid populations in three San Joaquin River tributaries (the Stanislaus, Merced, and Tuolumne Rivers) and the Bay-Delta. The Bay-Delta Plan Amendment requires the release of 30-50% of the "unimpaired flow"[16] on the three tributaries from February through June in every year type. In SFPUC modeling of the new flow standard, it is assumed that the required release is 40% of unimpaired flow.

If the Bay-Delta Plan Amendment is implemented, the SFPUC will be able to meet the projected water demands presented in this UWMP in normal years but would experience supply shortages in single dry years or multiple dry years. Implementation of the Bay-Delta Plan Amendment will require rationing in all single dry years and multiple dry years.

The SWRCB has stated that it intends to implement the Bay-Delta Plan Amendment on the Tuolumne River by the year 2022, assuming all required approvals are obtained by that time. But implementation of the Plan Amendment is uncertain for multiple reasons.

- Since adoption of the Bay-Delta Plan Amendment, over a dozen lawsuits have been filed in both state and federal courts, challenging the SWRCB's adoption of the Bay-Delta Plan Amendment, including a legal challenge filed by the federal government, at the request of the U.S. Department of Interior, Bureau of Reclamation. This litigation is in the early stages and there have been no dispositive court rulings as of this date.
- The Bay-Delta Plan Amendment is not self-implementing and does not automatically allocate responsibility for meeting its new flow requirements to the SFPUC or any other water rights holders. Rather, the Bay-Delta Plan Amendment merely provides a regulatory framework for flow allocation, which must be accomplished by other regulatory and/or adjudicatory proceedings, such as a comprehensive water rights adjudication or, in the case of the Tuolumne River, may be implemented through the water quality certification process set forth in section 401 of the Clean Water Act as part of the Federal Energy Regulatory Commission's (FERC) licensing proceedings for the Don Pedro and La Grange hydroelectric projects.

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[16] "Unimpaired flow represents the natural water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds." (Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Dec. 12, 2018) p.17, fn. 14, available at https://www.waterboards.ca.gov/plans_policies/docs/2018wqcp.pdf.)

- On January 15, 2021, the SWRCB released the Clean Water Act section 401 Water Quality Certification for the Turlock Irrigation District and Modesto Irrigation District Don Pedro Hydroelectric Project and La Grange Hydroelectric Project, FERC Project Nos. 2299 and 14581 (WQC). The WQC includes the 40% unimpaired flow objective from the Bay Delta Plan Amendment, as well as additional conditions that, if incorporated into FERC licenses for the Don Pedro and La Grange Projects, would severely impact SFPUC's water supply; the WQC's requirements differ significantly from the recommended flows and conditions that FERC has analyzed in the Staff Alternative of its Final Environmental Impact Statement for the licenses. To date, FERC has not taken action to incorporate the WQC into the licenses or to finalize the licenses for issuance. At this time, it is highly uncertain whether the WQC will be implemented by either the state or federal government for several reasons:

    - On February 16, 2021, multiple parties, including the City, Modesto and Turlock Irrigation Districts, and BAWSCA, filed with the SWRCB Petitions for Reconsideration of the WQC. Those petitions are currently pending before the SWRCB. In its March 15, 2021 order denying the Districts' request for a stay of the WQC, SWRCB stated that "[i]t is not the State Water Board's practice to seek enforcement while a petition for reconsideration of a certification is pending" and that "the State Water Board has *never* sought to enforce a certification before [a FERC] license is issued." (SWRCB, Order No. WQ 2021-0007-EXEC.) SWRCB emphasized that there was further "no information to support the conclusion that FERC will imminently issue licenses incorporating some or all of the certification." (Id.)

    - If the SWRCB denies the pending petitions for reconsideration or otherwise fails to revise or rescind the WQC, litigation is expected. In addition, the Districts filed a petition for declaratory order at FERC alleging that the SWRCB has waived its authority to issue the WQC, and they sought rehearing of FERC's January 19, 2021 order denying that petition. On March 22, 2021, FERC issued a Notice of Denial of Rehearing by Operation of Law and Providing for Further Consideration. The Districts have the option to appeal FERC's decision. These legal challenges could take years to resolve and may result in temporary or permanent stays of implementation of the WQC. FERC's policy is not to issue a license when a WQC has been stayed pending appeal within a state process. *See Alcoa Power Generating Inc.*, 130 FERC ¶ 61,037, P 15 (2010).

    - Aside from legal challenges, there are additional steps to complete in the licensing process before FERC is likely to issue the licenses: (a) completion of Endangered Species Act consultation, and (b) additional environmental review under NEPA to evaluate the WQC conditions. FERC also cannot issue the licenses without making a determination that the terms and conditions, including the requirements of the WQC, meet the statutory criteria of the Federal Power Act.

    - If FERC were to issue license(s) for the Don Pedro and La Grange Projects incorporating the current WQC, the Districts and other parties to the licensing proceeding would have the option to seek rehearing of FERC's licensing order, and depending on the outcome of that process, then challenge the license(s) in the court and seek a stay. The Districts would also have the option to refuse to accept the license(s).

Due to the above, it is speculative whether the current WQC will be placed in the FERC licenses and when these licenses will be issued. Accordingly, this UWMP does not model projections of SFPUC water supply under the WQC.

In recognition of the obstacles to implementation of the Bay-Delta Plan Amendment, the SWRCB Resolution No. 2018-0059 adopting the Bay-Delta Plan Amendment directed staff to help complete a "Delta watershed-wide agreement, including potential flow measures for the Tuolumne River" by March 1, 2019, and to incorporate such agreements as an "alternative" for a future amendment to the Bay-Delta Plan to be presented to the SWRCB "as early as possible after December 1, 2019." In accordance with the SWRCB's instruction, on March 1, 2019, the SFPUC, in partnership with other key stakeholders, submitted a proposed project description for the Tuolumne River that could be the basis for a voluntary substitute agreement with the SWRCB ("March 1st Proposed Voluntary Agreement"). On March 26, 2019, the SFPUC adopted Resolution No. 19-0057 to support the SFPUC's participation in the Voluntary Agreement negotiation process. To date, those negotiations are ongoing under the California Natural Resources Agency and the leadership of the Newsom administration.[17]

Because of the uncertainty surrounding implementation of the Bay-Delta Plan Amendment, the water service reliability assessment presented in Section 8 of this draft UWMP looks at two future supply scenarios, both with and without implementation of the Bay-Delta Plan Amendment. Although the SWRCB has stated it intends to implement the Bay-Delta Plan Amendment on the Tuolumne River by the year 2022, given the current level of uncertainty, it is assumed for the purposes of this draft UWMP that the Bay-Delta Plan Amendment will be fully implemented starting in 2023.

7.3.2 Potential State and Federal Regulations

The SFPUC's operation of the RWS is subject to numerous State and federal agency permits designed to protect drinking water quality and the environment. Some permit requirements have been in place for decades and influence the way water supply is managed. Requirements for instream flows, for example, may increase the releases or bypass flow from SFPUC facilities. In the Tuolumne River watershed, the SFPUC currently maintains a specific flow release schedule downstream of Hetch Hetchy Reservoir, Cherry Lake, and Lake Eleanor. When the WSIP was analyzed in the PEIR, local system reservoirs had no formal flow release requirements, so no instream flow release and bypass requirements were reflected in the water supply program for the Calaveras Dam Replacement and Lower Crystal Springs Dam Improvement Projects. However, as noted earlier, changes to the flow schedules for dams on Alameda and San Mateo Creeks that resulted from project permitting impacted the water supply reliability of the RWS. Permitting for future projects may further impact water supply reliability through additional instream flow release or bypass requirements.

As described in Section 3.1.4, the SFPUC uses a portion of Don Pedro Reservoir as a water bank under agreement with the Districts. The re-licensing of the Don Pedro reservoir by FERC may require additional water released from the reservoir for the preservation of aquatic species in the lower Tuolumne River, potentially affecting the yield of the RWS by reducing the balance of water stored in the water bank. The final Environmental Impact Statement was released by FERC on July 7, 2020. There is no schedule for when FERC will issue the relicense.

7.3.3 Additional Water Supply Decisions

In the 2009 WSA, the SFPUC committed to make two decisions before the end of 2018 that affect water supply development:

- Whether or not to make the Cities of San Jose and Santa Clara permanent customers of the RWS, and
- Whether or not to increase Supply Assurance above 184 mgd to meet future Wholesale Customer demands.

The SFPUC determined prior to 2018 that it needed to reevaluate water system demands and supply options, and conduct additional supply reliability studies and environmental reviews necessary to address the water supply decisions. As a result, instead of arriving at a decision point in 2018, the SFPUC and the Wholesale Customers updated the WSA and deferred the supply decisions to 2028 to allow the SFPUC to conduct the necessary water supply planning and CEQA analysis.

The SFPUC's planning efforts to fulfill the water supply needs for the Cities of San Jose and Santa Clara are included in the Alternative Water Supply Program as described further below in Section 7.4.

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[17] California Natural Resources Agency, "Voluntary Agreements to Improve Habitat and Flow in the Delta and its Watersheds," available at **https://files.resources.ca.gov/voluntary-agreements/**.

7.4 ALTERNATIVE WATER SUPPLY PROGRAM

The SFPUC is increasing and accelerating its efforts to acquire additional water supplies and explore other projects that would increase overall water supply resilience through the Alternative Water Supply Planning Program. The drivers for the program include: (1) the adoption of the Bay-Delta Plan Amendment and the resulting potential limitations to RWS supply during dry years, (2) the net supply shortfall following the implementation of WSIP, (3) San Francisco's perpetual obligation to supply 184 MGD to the Wholesale Customers, (4) adopted Level of Service (LOS) Goals and Objectives to limit rationing to no more than 20 percent system-wide during droughts, and (5) the potential need to identify water supplies that would be required to offer permanent status to interruptible customers. Developing additional supplies through this program would reduce water supply shortfalls and reduce rationing associated with such shortfalls. The planning priorities guiding the Alternative Water Supply Program are as follows:

1. Offset instream flow needs and meet regulatory requirements
2. Meet existing obligations to existing permanent customers
3. Make interruptible customers permanent
4. Meet increased demands of existing and interruptible customers

In conjunction with these planning priorities, the SFPUC considers how the new framework fits within the LOS Goals and Objectives related to water supply and sustainability when considering new water supply opportunities. The SFPUC adopted LOS Goals and Objectives in 2008, in conjunction with the adoption of WSIP. The key LOS Goals and Objectives relevant to this effort can be summarized as:

- Meet dry-year delivery needs while limiting rationing to a maximum of 20 percent system-wide reduction in water service during extended droughts;
- Diversify water supply options during non-drought and drought periods;
- Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers;
- Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat;
- Maintain operational flexibility (although this LOS Goal was not intended explicitly for the addition of new supplies, it is applicable here).

Together, the planning priorities and LOS Goals and Objectives provide a lens through which the SFPUC considers water supply options and opportunities to meet all foreseeable water supply needs.

In addition to the Daly City Recycled Water Expansion project[18], which was a potential project identified in the 2015 UWMP and had committed funding at that time, the SFPUC has taken action to fund the study of several other potential additional water supply projects. Capital projects under consideration to develop additional water supplies include surface water storage expansion, recycled water expansion, water transfers, desalination, and potable reuse projects. A more detailed list and descriptions of these efforts are provided below.

The capital projects that are under consideration would be costly and are still in the early feasibility or conceptual planning stages. Because these water supply projects would take 10 to 30 years to implement, and because required environmental permitting negotiations may reduce the amount of water that can be developed, the yield from these

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[18] While this potential project was identified in the 2015 UWMP, it has since been approved by Daly City following environmental review and has a higher likelihood of being implemented.

projects are not currently incorporated into the SFPUC's supply projections. State and federal grants and other financing opportunities would be pursued for eligible projects, to the extent feasible, to offset costs borne by ratepayers.

If all the projects identified through the current planning process could be implemented, there would still be a supply shortfall to meet projected needs. Furthermore, each of the supply options being considered has its own inherent challenges and uncertainties that may affect the SFPUC's ability to implement it.

Given the limited availability of water supply alternatives - unless the supply risks are significantly reduced or the SFPUC's needs change significantly - the SFPUC will continue to plan, develop, and implement all project opportunities that can help bridge the anticipated water supply gaps during droughts. In 2019, the SFPUC completed a survey among water and wastewater agencies within the SFPUC's service area to identify additional opportunities for purified water. Such opportunities remain limited, but the SFPUC continues to pursue all possibilities.

The SFPUC will prepare an Alternative Water Supply Plan by July 2023, which will include a planning framework that will consider water supply needs and related tradeoffs, guide the decisions to proceed with environmental review, and continue the development of projects that can best meet anticipated water supply needs. In the meantime, the SFPUC has been preparing quarterly reports that provide an update on the status of planning efforts regarding the regional and local water supply, storage, and related infrastructure planned projects.

The following capital projects are the alternative local and regional water supply and storage projects that represent the SFPUC's early planning to meet future water supply challenges and vulnerabilities, such as environmental flow needs and other regulatory changes, earthquakes, disasters and emergencies, population and employment increases, and climate change.

7.4.1 Local Projects

San Francisco Purified Water. The San Francisco Purified Water Project envisions providing a new, local drinking water supply in San Francisco. The project would treat secondary effluent sourced from the SFPUC's Southeast Treatment Plant or Oceanside Treatment Plant through a multi-stage, multi-barrier advanced treatment process to produce water that meets state and federal drinking water standards. The treated water would then be blended at one or more of San Francisco's drinking water reservoirs. Before engaging at a project-level, the SFPUC will participate in research and data collection around water quality and process reliability for purified water opportunities.

With the successful completion of PureWaterSF, San Francisco's initial research and demonstration of a small-scale Direct Potable Reuse (DPR) project, the SFPUC is beginning to plan next steps for the development of purified water. SFPUC staff has begun putting together a scope of work to consider the size and scope of purified water opportunities in San Francisco, as well as identify research, training and outreach needs.

Satellite Recycled Water. A potential Satellite Recycled Water Project would provide a tertiary recycled water supply to meet the demands of dual plumbed buildings in San Francisco that do not currently have a non-potable water supply source. This project would provide an appropriate water supply source for non-potable irrigation, as well as commercial and industrial uses not addressed by the Non-Potable Water Ordinance.

Innovations Program. This program supports the development of new technologies and initiatives. Included in the Innovations Program are demonstrations of new technologies and grant funds to support partnership opportunities. Examples of projects within the Innovations Program include a grant program to treat process in breweries, and grants to support onsite reuse projects with heat recovery systems. The SFPUC is also pursuing a prospective project to expand leak detection and a project to test atmospheric water generation technology.

Potable Offset Potential. The purpose of this project is to explore the potential to offset the incremental water demand associated with large new developments in San Francisco. Through coordination with other City departments such as Planning and the Department of Building Inspection, the SFPUC will identify options and potable water thresholds that may result in policy recommendations. The first step in the planning process will be to survey proposed developments to determine the volume and characteristics of incremental demand that are not already being offset by the Non-Potable Water Ordinance or other existing requirements. An initial review of existing potable offset programs has been conducted.

7.4.2 Regional Projects

Daly City Recycled Water Expansion. This project has been designed to produce up to 3 mgd of tertiary recycled water during the irrigation season (~7 months). On an average annual basis, this is equivalent to 1.25 mgd or 1,400 acre-feet per year. The project is envisioned to provide recycled water to 13 cemeteries and other smaller irrigation customers, offsetting existing groundwater pumping from the South Westside Groundwater Basin; this will increase groundwater storage, enhancing the reliability of the GSR Project in the Basin. The project is a regional partnership between the SFPUC the City of Daly City, and the California Water Service Company, whose service area includes numerous irrigators using a combination of groundwater and surface water from the RWS. RWS customers will benefit from the increased reliability of the South Westside Basin for additional drinking water supply during droughts.

ACWD-USD Purified Water Partnership. This project could provide a new purified water supply to the RWS utilizing Union Sanitary District's (USD) treated wastewater. Purified water produced by advanced water treatment at USD in the East Bay could be transmitted to the Quarry Lakes Groundwater Recharge Area to supplement recharge into the Niles Cone Groundwater Basin as part of an indirect potable reuse project or be put to other uses in ACWD's service area. With the latter option, providing additional water supply to ACWD as part of an in-lieu exchange with the SFPUC would result in more water left in the RWS. Additional water supply could also be directly transmitted to the SFPUC through a new intertie between ACWD and the SFPUC.

Crystal Springs Purified Water. The Crystal Springs Purified Water Project, also referred to as the Potable Reuse Exploratory Plan (PREP) is a purified water project (indirect potable reuse) that could provide 6-12 mgd of water supply through reservoir water augmentation at Crystal Springs Reservoir, which is a facility of the RWS. Treated wastewater from Silicon Valley Clean Water (SVCW) and/or the City of San Mateo would go through an advanced water treatment plant to produce purified water that meets state and federal drinking water quality standards. The purified water would then be transmitted 10-20 miles (depending on the alignment) to Crystal Springs Reservoir, blended with regional surface water supplies, and treated again at Harry Tracy Water Treatment Plant.

Los Vaqueros Reservoir Expansion. The Los Vaqueros Reservoir Expansion (LVE) Project is a multi-agency storage project that will enlarge the existing reservoir located in northeastern Contra Costa County from 160,000 acre-feet to 275,000 acre-feet. While the existing reservoir is owned and operated by Contra Costa Water District (CCWD), the expanded reservoir will have regional benefits for numerous water agencies and their customers and will be managed by a Joint Powers Authority (JPA) that will be set up prior to construction. Meanwhile, CCWD is leading the planning, design and environmental review efforts. CCWD's Board certified the EIS/EIR and approved the LVE Project on May 13, 2020.

The additional storage capacity from the LVE Project would provide a dry year water supply benefit to the SFPUC. However, the challenges of securing a water supply to store in the SFPUC's portion of reservoir and ensuring there is an available path for conveyance of that water supply to and from the reservoir may both be significant barriers to realizing the full water supply potential of storage for SFPUC customers. In particular, issues related to conveyance must be better understood before the SFPUC can determine the extent of its participation in the LVE project. As such, this project is being planned in conjunction with the following projects described below: Conveyance Alternatives, the Bay Area Regional Reliability (BARR) Shared Water Access Program, and the Bay Area Brackish Water Desalination Project.

Conveyance Alternatives. The SFPUC is considering two main pathways to move water from storage in a prospective LVE Project to the SFPUC's service area: either directly to RWS facilities or indirectly via an exchange with partner agencies. The SFPUC is evaluating potential alignments for conveyance.

The Bay Area Regional Reliability (BARR) Shared Water Access Program. As part of the BARR Partnership, a consortium of 8 Bay Area water utilities (including ACWD, BAWSCA, CCWD, East Bay Municipal Utility District (EBMUD), Marin Municipal Water District (MMWD), SFPUC, Valley Water, and Zone 7 Water Agency) are exploring opportunities to move water across the region as efficiently as possible, particularly during times of drought and emergencies. The BARR agencies are proposing two separate pilot projects in 2020-2021 through the Shared Water Access Program (SWAP) to test conveyance pathways and identify potential hurdles to better prepare for sharing water during a future drought or emergency. A strategy report identifying opportunities and considerations will accompany these pilot projects and will be completed in 2021.

Bay Area Brackish Water Desalination. The Bay Area Brackish Water Desalination (Regional Desalination) Project is a partnership between CCWD, SFPUC, Valley Water, and Zone 7 Water Agency. EBMUD and ACWD may also participate in the project. The project could provide a new drinking water supply to the region by treating brackish water from CCWD's existing Mallard Slough intake in Contra Costa County. While this project has independent utility as a water supply project, for the current planning effort the SFPUC is considering it as a source of supply for storage in LVE. While the allocations remain to be determined among partners, the SFPUC is considering the project would provide a water supply benefit to its customers of between 5 and 15 mgd during drought conditions when combined with storage at LVE.

Calaveras Reservoir Expansion. This storage project envisions the expansion of the existing Calaveras Reservoir to create up to 289,000 AF of additional capacity to store excess RWS supplies or other source water in wet and normal years. In addition to reservoir enlargement, the project would involve infrastructure to pump water to the reservoir, such as pump stations and transmission facilities. Unlike the other regional projects under review in this program, no external partners are anticipated for this project. The SFPUC has conducted a preliminary analysis reviewing potential dam raise scenarios, which indicated that an expansion of the dam at various elevations is technical feasible. Water supply, conveyance, and capacity constraints at related facilities will be evaluated.

Groundwater Banking. Groundwater banking in the Modesto Irrigation District (MID) and Turlock Irrigation District (TID) service areas could be used to provide some additional water supply to meet instream releases in dry years, reducing water supply impacts to the SFPUC service area. For example, additional surface water could be provided to irrigators in wet years, which would offset the use of groundwater, thereby allowing the groundwater to remain in the basin rather than be consumptively used. The groundwater that remains in the basin can then be used in a subsequent dry year for irrigation, freeing up surface water that would have otherwise been delivered to irrigators to meet instream flow requirements.

Feasibility study of this option is included in the proposed Tuolumne River Voluntary Agreement. Progress on this potential water supply option will depend on the negotiations of the Voluntary Agreement.

Inter-Basin Collaborations. Inter-Basin Collaborations could provide net water supply benefits in dry years by sharing responsibility for in-stream flows in the San Joaquin River and Delta more broadly among several tributary reservoir systems. One mechanism by which this could be accomplished would be to establish a partnership between interests on the Tuolumne River and those on the Stanislaus River, which would allow responsibility for streamflow to be assigned variably based on the annual hydrology.

As is the case with Groundwater Banking, feasibility of this option is included in the proposed Tuolumne River Voluntary Agreement.

Dry-Year Transfers. WSIP included a water transfer between the SFPUC and other water users on the Tuolumne River. In 2012, staff of the SFPUC and MID developed a term sheet for a 2 mgd dry-year water supply transfer for approval by their governing boards. The SFPUC and MID were ultimately unable to reach agreement on mutually beneficial terms and the water transfer negotiations were terminated. Subsequently, the SFPUC began discussions with the Oakdale Irrigation District (OID) for a one-year transfer agreement with the SFPUC for 2 mgd. No progress towards agreement on a transfer was made in 2020, but the irrigation districts recognize the SFPUC's continued interest, and the SFPUC is continuing to pursue transfers in conjunction with ongoing discussions associated with the implementation of the Bay-Delta Plan Amendment.

7.5 BAY AREA REGIONAL EFFORTS TO IMPROVE WATER SUPPLY RELIABILITY

The following projects and efforts are currently underway or completed and will help the RWS meet its water supply reliability needs. Some of these projects are reflected in the SFPUC's current strategy for meeting water supply needs described above. As the remainder of these projects move through the planning stages, they will continue to inform the SFPUC's water supply strategy.

Bay Area Regional Reliability. The SFPUC is continuing to work with seven water agencies in the Bay Area (ACWD, BAWSCA, CCWD, EBMUD, MMWD, Valley Water and Zone 7 Water Agency) to investigate opportunities for collaboration, particularly during future droughts. The purpose of this planning effort, known as Bay Area Regional Reliability (BARR), is to identify projects and processes to enhance water supply reliability across the region, leverage existing infrastructure investments, facilitate water transfers during critical shortages, and improve climate change resiliency. In 2017, with funding support from the U.S. Bureau of Reclamation, the BARR partner agencies completed a Drought Contingency Plan. The Plan identified short-term response actions and longer-term projects that could facilitate the sharing of infrastructure for the benefit of the region including interties, expanded storage, new water supply and operational improvements. To further evaluate the potential for building regional resilience, in 2019 the BARR partners (with the exception of MMWD) initiated development of the Bay Area Shared Water Access Program (Bay Area SWAP). The Bay Area SWAP effort has also received funding support from the U.S. Bureau of Reclamation and is ongoing. The goal of Bay Area SWAP is to develop a Strategy Report outlining an implementation plan to facilitate transfers to and exchanges within the Bay Area, leveraging existing infrastructure and institutional agreements and identifying new components that may be needed. Through the Drought Contingency Plan and Bay Area SWAP efforts, the BARR partner agencies have convened a Stakeholder Task Force to provide stakeholders, interested parties and BARR partners an opportunity for meaningful engagement and input.

Regional Interties. Regional interties help increase the reliability of the RWS by allowing for water exchanges during emergencies, water shortages, or maintenance.

- **EBMUD-Hayward-SFPUC Emergency Intertie:** In 2002, the SFPUC formed a partnership with EBMUD and the City of Hayward to construct Skywest Pump Station and 1.5 miles of pipeline to link their systems. These facilities can convey up to 30 mgd among these three agencies to boost water supply reliability when needed. EBMUD and the SFPUC own these facilities jointly, while the City of Hayward maintains and operates them in coordination with EBMUD and the SFPUC.

- **SFPUC-Valley Water Emergency Intertie:** The SFPUC and Valley Water maintain a 40-mgd intertie between their two systems at Milpitas to exchange water during emergencies and planned maintenance. The intertie has been used on several occasions during maintenance of Valley Water's system.

- **South Bay Aqueduct Interties:** In the 1990s, the SFPUC used a temporary intertie from the South Bay Aqueduct into San Antonio Reservoir for water a two-year water transfer. To enable deliveries from the Los Vaqueros Reservoir Expansion project, the SFPUC is evaluating the potential for a new intertie.

Bay Area Integrated Regional Water Management Plan. The SFPUC chairs the nine-county Bay Area Integrated Regional Water Management Plan Coordinating Committee. The BAIRWMP was first completed in November 2006 and was updated in 2013 and 2019. The BAIRWMP describes the region’s water supply and water quality, wastewater and water recycling, storm water and flood protection, and habitat protection and ecosystem restoration objectives and efforts. The BAIRWMP also identifies integrated and collaborative projects among Bay Area agencies. To date, the Bay Area has received $148.5 million in Propositions 50 and 84 Integrated Regional Water Management (IRWM) implementation grant funding. More recently, the Bay Area received $65 million in Proposition 1 IRWM grant funding for implementation, planning, and disadvantaged community involvement efforts.

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SECTION 8: WATER SUPPLY RELIABILITY ASSESSMENT

8.1 CONSTRAINTS ON SUPPLIES

The list below summarizes the legal, environmental, water quality, climatic, and other factors potentially resulting in inconsistent supply.

- **RWS:** As described previously, there may be shortfalls of RWS supplies in dry years as a result of several factors, including required instream flow releases (see Section 7.3) as well as climate change (see Section 6.1.3).

- **Retail Groundwater:** Groundwater supplies are typically limited by the quality and quantity of available supplies. However, the probability of these impacts occurring is low with proper management of the Westside Groundwater Basin as described in Section 6.2.1.1.

- **Retail Recycled Water:** Recycled water is limited by water quality requirements that legally restrict recycled water supply for some uses. However, recycled water supplies discussed herein are treated, or are planned to be treated, to the standards established by State agencies that are required for each designated end use. As a result, no limitations on use of recycled water for designated purposes are expected to occur.

The adoption of the Bay-Delta Plan Amendment may significantly impact the supply available from the RWS. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect. As a result, it makes sense to conduct future supply modeling for a scenario that doesn't include implementation of the Bay-Delta Plan Amendment, as that represents a potential supply reliability scenario.

Because of the uncertainty surrounding implementation of the Bay-Delta Plan Amendment, the following water service reliability assessment includes two sets of tables: (1) a scenario in which the Bay-Delta Plan Amendment is fully implemented in 2023, and (2) a scenario that considers the SFPUC system's current situation without the Bay-Delta Plan Amendment. The two scenarios provide a bookend for the possible future scenarios regarding RWS supplies. The standardized tables associated with this UWMP contain the future scenario that assumes implementation of the Bay-Delta Plan Amendment starting in 2023.

8.2 WATER SUPPLY MODELING

8.2.1 Data & Methods

The SFPUC used the Hetch Hetchy and Local Simulation Model (HHLSM) to perform the water supply analyses for the supply reliability assessment and the drought risk assessment. HHLSM combines a historical record of hydrology from 1920 through 2017 with a current representation of SFPUC RWS infrastructure and operations. The simulated operations include decisions on water supply rationing during droughts. The use of those results is described below.

A key input for the HHLSM model is the anticipated level of demand on the RWS. Supply modeling results presented in the text of this plan reflect an input of projected demands on the RWS consisting of (1) projected retail demands on the RWS (total retail demands minus local groundwater and recycled water supplies, see Table 4-1 and Table 6-5), and (2) projected Wholesale Customer purchases (see Table 4-3). The SFPUC has a Level of Service objective of meeting average annual water demand of 265 mgd from the SFPUC watersheds for retail and Wholesale Customers during non-drought years, as well as a contractual obligation to supply 184 mgd to the Wholesale Customers. Therefore, the SFPUC has also conducted modeling based on a demand of 265 mgd in order to facilitate planning that supports meeting this Level of Service goal and our contractual obligations. The results of this modeling can be found in Appendix J.

Note that, as shown in Appendix J, in a normal year the SFPUC can provide up to 265 mgd of supply from the RWS. Supply projections shown in this section are more accurately characterized as supplies that will be used to meet projected retail and wholesale customer demands.

8.2.2 Design Drought

In the six-year period from 1987-92, a shortfall developed between the SFPUC's supplies and its customers' demands such that significant rationing of water supply became necessary. Other than during the drought of 1976-77, drought sequences in the past did not seriously affect the ability of the RWS to sustain full deliveries to its retail and wholesale customers. Following the 1987-92 drought experience, the SFPUC includes the concept of its "firm" capability in water supply planning, which is defined as the amount of water the RWS can be expected to deliver during drought periods.

The SFPUC uses a hypothetical drought that is more severe than what the RWS has historically experienced. This drought sequence is referred to as the "design drought" and serves as the basis for planning and modeling of future scenarios. The design drought consists of the 1987-92 drought, followed by an additional 2.5 years of dry conditions from the hydrologic record that include the 1976-77 drought. While the latest drought (2012-2015) consists of some of the driest years on record for the SFPUC's watersheds, the design drought still represents a more severe drought in duration and overall water supply deficit.

More specifically, the design drought sequence used by the SFPUC for reliability planning is an 8.5-year period composed of the following elements:

- **Historical Hydrology:** A six-year sequence of hydrology from the historical drought that occurred from July 1986 to June 1992;

- **Prospective Drought:** A 2.5-year period that includes the 1976-77 drought (to represent a drought sequence worse than historical); and

- **System Recovery Period:** The last six months of the design drought are the beginning of the system recovery period. The precipitation begins in the fall, and by approximately the month of December, inflow to RWS reservoirs exceeds customer demands and SFPUC system storage begins to recover.

8.2.3 Definition of Water Supply Scenarios *(Normal, Dry, and Multi-dry Years)*

The total amount of water the SFPUC can deliver to retail and wholesale customers depends on several factors, including the amount of water that is available to the SFPUC from natural runoff, the amount of water in reservoir storage, and the amount of that water that must be released from the RWS for purposes other than customer deliveries (e.g., required instream flow releases below RWS reservoirs). For planning purposes, the SFPUC "normal year" is based on historical hydrology under conditions that allow the reservoirs to be filled over the course of the snowmelt season, allowing full deliveries to customers.

For dry-year supply scenarios, the SFPUC plans its water deliveries using indicators for water supply rationing that are developed through analysis with the design drought sequence described above. As a result, the SFPUC system operations are designed to provide sufficient carry-over water in SFPUC reservoirs to continue delivering water, although at reduced levels, during and after multiple-year droughts.

The supply reliability assessment presented herein assumed the statuses of the ongoing WSIP projects shown in Table 8-1. The WSIP projects will contribute to reducing the anticipated RWS supply reductions in a multi-dry year event.

The levels of water supply deficiency presented for this 2020 UWMP were estimated using the design drought methodology discussed above. The five-consecutive-year dry sequence shown in the tables below represents years 2 through 6 of the design drought; this sequence was chosen because year 2 is the first year when system-wide rationing would come into effect. The results are presented in the standardized format prescribed by DWR for use in the 2020 UWMPs.

Table 8-2 summarize the expected availability of local groundwater, recycled water, and RWS supplies under normal, single dry, and multiple dry year conditions. These are the bases for the retail and wholesale supply reliability assessments presented in Sections 8.3 and 8.4. The SFPUC currently operates under a plan that anticipates multiple stages of response to water supply shortages, ranging from use of dry year water supplies (when available) and voluntary customer water reductions to enforced rationing.

For RWS supplies, supply modeling both with and without the implementation of the Bay-Delta Plan Amendment is included here. The two modeled scenarios show significantly different supply reliability projections for the RWS:

- **With Full Implementation of the Bay-Delta Plan Amendment:** Under the Bay-Delta Plan Amendment conditions, it is anticipated that the RWS supplies will experience a reduction of up to 55% through the multiple dry-year sequence. The implementation of the Alternative Water Supply Program and associated potential projects will help reduce the anticipated supply shortfalls.

- **Without Implementation of the Bay-Delta Plan Amendment:** Assuming the availability of existing supplies at current demand levels, the SFPUC system can expect to experience no RWS supply reductions until the level of demand anticipated in 2045 is reached. At that level of demand, 10% shortages of RWS supply would occur in years 4 and 5 of the five-consecutive dry year sequence.

Table 8-1. WSIP Project Assumptions for RWS Supply Modeling

Projects	Base Year 2020	Base Year 2025 and Beyond
Calaveras Dam Replacement Project	Calaveras Reservoir partially refilled at spring 2020 level of 63,900 AF	Calaveras Reservoir fully refilled
Lower Crystal Springs Dam Improvements	Crystal Springs storage not fully restored	Crystal Springs storage not fully restored
Regional Groundwater Storage and Recovery (GSR) Project	GSR account partially filled at spring 2020 level of 23,500 AF; GSR recovery rate of 6.2 mgd[a]	GSR account fully filled; GSR recovery rate of 6.2 mgd[a]
Alameda Creek Recapture Project	Project not built	Project built
Dry-year Transfers	Not in effect	Not in effect

[a] The GSR Project was intended to provide 7.2 mgd over 7.5 years, however current limitations on the number of wells available will result in deliveries less than 7.2 mgd over 7.5 years.

Table 8-2. Retail Groundwater and Recycled Water Supply Availability During Normal and Dry Years Using 2025 Base Year

[Standardized Table 7-1 Retail: Bases of Water Year Data]

Water Supply	**Normal Year**	**Single Dry Year**	**Multiple Dry Years**				
			Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Projected Years 2025 through 2045 (post-WSIP completion) – both with and without Bay-Delta Plan Amendment							
Local Groundwater[a]	100%	100%	100%	100%	100%	100%	100%
Local Recycled Water[a]	100%	100%	100%	100%	100%	100%	100%

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability. Groundwater and recycled water availability are not impacted by the implementation of the Bay-Delta Plan Amendment.

a Local supplies are available only to meet retail demands.

Table 8-3. Regional Water System Supply Availability During Normal and Dry Years for Base Years 2025 through 2045 – With and Without Bay-Delta Plan Amendment

Base Year	**Normal Year[a]**	**Single Dry Year**	**Multiple Dry Years**				
			Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
With Bay-Delta Plan Amendment							
2020[b]	100%	100%	100%	100%	60%	60%	60%
2025	100%	70%	70%	60%	60%	60%	60%
2030	100%	70%	70%	60%	60%	60%	60%
2035	100%	70%	70%	60%	60%	60%	55%
2040	100%	70%	70%	60%	60%	53%	53%
2045	100%	60%	60%	60%	60%	51%	51%
Without Bay-Delta Plan Amendment							
2020	100%	100%	100%	100%	100%	100%	100%
2025	100%	100%	100%	100%	100%	100%	100%
2030	100%	100%	100%	100%	100%	100%	100%
2035	100%	100%	100%	100%	100%	100%	100%
2040	100%	100%	100%	100%	100%	100%	100%
2045	100%	100%	100%	100%	100%	90%	90%

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability.

RWS supplies are available to meet both retail and wholesale demands. Retail and wholesale allocations are provided in Section **Error! Reference source not found.** (Table 8-4 and Error! Reference source not found. for retail, and Table 8-5 and Table 8-7 for wholesale)

a Normal year supply corresponds to values shown in Table 6-1.

b For base year 2020, the Bay-Delta Plan Amendment is assumed to come into effect in 2023, which is shown here as Year 3 of the multiple dry year sequence.

8.2.4 Allocating Regional Water System Supply

In order to compare retail and wholesale supplies and demands, the available RWS supply in a dry year must first be allocated between the Retail and Wholesale Customers. Procedures to allocate RWS supplies between Retail and Wholesale Customers during system shortages are specified in the SFPUC's Water Shortage Allocation Plan (WSAP), which is an appendix to the Water Supply Agreement. The WSAP is further described in Appendix K. The WSAP defines a percentage split between Retail and Wholesale Customers at different RWS system-wide shortage levels. For example, at a 10% RWS shortage, 36% of available RWS supply is allocated to the Retail Customers, and 64% to the Wholesale Customers. Appendix K presents the percentage splits between Wholesale and Retail Customers at different shortage levels. Per the WSAP, in the event that the retail share of the available water supply results in retail customers having a positive allocation (i.e. a supply of additional water rather than a percentage reduction in water use), the share of the available water supply for retail customers shall be reduced to eliminate any positive allocation, with a corresponding increase in the percentage share of the available water supply allocated to the Wholesale Customers.

In addition, as amended in 2018, the WSAP requires Retail Customers to conserve a minimum of 5% during droughts. If retail demands on the RWS are lower than the retail allocation in a dry year, it is assumed that the retail customers will achieve a 5% demand reduction.

8.3 WATER SUPPLY AND DEMAND COMPARISONS, WITH BAY-DELTA PLAN AMENDMENT

The following sections summarize the projected retail and wholesale supplies and demands during normal, single dry, and multiple dry years for the scenario with full implementation of the Bay-Delta Plan Amendment. The demand assumptions for this analysis are as follows:

- Total retail demands are presented in Section 4.1 and reflect active and passive conservation, onsite water reuse savings, and water loss.
- Wholesale Customer purchase request projections as presented in Table 4-3. A reliability assessment for the Level of Service objective of 265 mgd, which includes the Supply Assurance of 184 mgd, is presented in Appendix J.

Supplies are listed by source: RWS, groundwater (retail only) and recycled water (retail only). The difference between supply and demand, resulting in either a supply surplus or deficit, is also provided for each scenario. As noted earlier, Groveland CSD is accounted for as a retail customer in this section, but, but as a wholesale customer in the corresponding standardized tables in Appendix B.

8.3.1 Retail Water Service Reliability Assessment – With Bay-Delta Plan Amendment

The instream flow requirements of the Bay-Delta Plan Amendment would impact the RWS supplies in the dry-year and multi-dry scenarios. The comparison of retail demands and supplies under the Bay-Delta Plan Amendment is presented in Table 8-4 and demonstrates the following:

- **Normal Years:** During normal hydrologic years, the SFPUC will have adequate supplies to meet its projected retail water demands.
- **Single Dry Year:** During single dry years, there would be an anticipated 30 - 40% shortage of RWS supplies, as described in Table 8-2. When the available RWS supply is allocated between retail and Wholesale Customers (described in Section 8.2.4), and the supplies available to retail customers (RWS plus local supplies) are

compared to the projected retail demands (as shown in Table 8-4), a retail supply shortfall of 14% to 25% (11 – 20 mgd) is expected in single dry year conditions.

- **Multiple Dry Years:** If a multiple dry year event occurs, there would be anticipated shortages in RWS supplies of 30 to 49%, depending on demand levels. When the available RWS supply is allocated between retail and Wholesale Customers (described in Section 8.2.4), and the supplies available to retail customers (RWS plus local supplies) are compared to the projected retail demands (as shown in Table 8-4), there is an anticipated shortfall of up to 35%, or almost 29 mgd, by the fifth dry year at 2045 projected levels of demand.

8.3.2 Wholesale Water Service Reliability Assessment – With Bay-Delta Plan Amendment

The comparison of wholesale demands and supplies under the Bay-Delta Plan Amendment presented in Table 8-5 demonstrates the following:

- **Normal Years:** During normal hydrologic years, the SFPUC will have adequate supplies to meet its projected wholesale water demands.

- **Single Dry Year:** During single dry years, there would be an anticipated 30 - 40% shortage of RWS supplies, as described in Table 8-2. When the available RWS supply is allocated between retail and Wholesale Customers (described in Section 8.2.4), and the Wholesale Customer allocation is compared to the projected Wholesale Customer demand (as shown in Table 8-5), this would result in a 36 to 46% (53 – 74 mgd) shortfall for the Wholesale Customers.

- **Multiple Dry Years:** In a multiple dry year event, there would be anticipated shortages in RWS supplies for all projected years, ranging from 30 to 49% shortages. When the available RWS supply is allocated between retail and Wholesale Customers (described in Section 8.2.4), and the Wholesale Customer allocation is compared to the projected Wholesale Customer demand (as shown in Table 8-5), these RWS shortages would result in up to 54% shortfalls for the Wholesale Customers.

Table 8-4. Retail Supply and Demand Comparison for Projected Normal & Dry Year Scenarios With Bay-Delta Plan Amendment (mgd)

[Standardized Table 7-2 Retail: Normal Year Supply and Demand Comparison]

[Standardized Table 7-3 Retail: Single Dry Year Supply and Demand Comparison]

[Standardized Table 7-4 Retail: Multiple Dry Years Supply and Demand Comparison]

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years[b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2025	Total Retail Demand	70.7	70.7	70.7	70.7	70.7	70.7	70.7
	Baseline Retail Demand[c]	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	70.7	59.5	59.5	51.5	51.5	51.5	51.5
	Retail Groundwater[e]	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
	Retail Recycled Water[f]	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
	RWS Supply Utilized by Retail[g]	***67.2***	***56.0***	***56.0***	***48.0***	***48.0***	***48.0***	***48.0***
	Difference (Supply Surplus or Shortfall)	0.0	-11.2	-11.2	-19.2	-19.2	-19.2	-19.2
	Difference as Percentage of Demand	0.0%	-15.9%	-15.9%	-27.2%	-27.2%	-27.2%	-27.2%
2030	Total Retail Demand	72.4	72.4	72.4	72.4	72.4	72.4	72.4
	Baseline Retail Demand[c]	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	72.4	61.4	61.4	53.4	53.4	53.4	53.4
	Retail Groundwater[e]	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	***67.5***	***56.5***	***56.5***	***48.5***	***48.5***	***48.5***	***48.5***
	Difference (Supply Surplus or Shortfall)	0.0	-11.0	-11.0	-19.0	-19.0	-19.0	-19.0
	Difference as Percentage of Demand	0.0%	-15.1%	-15.1%	-26.3%	-26.3%	-26.3%	-26.3%
2035	Total Retail Demand	74.5	74.5	74.5	74.5	74.5	74.5	74.5
	Baseline Retail Demand[c]	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	74.5	63.8	63.8	55.5	55.5	55.5	51.4
	Retail Groundwater[e]	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	***68.6***	***57.9***	***57.9***	***49.6***	***49.6***	***49.6***	45.5
	Difference (Supply Surplus or Shortfall)	0.0	-10.7	-10.7	-19.0	-19.0	-19.0	-23.1
	Difference as Percentage of Demand	0.0%	-14.4%	-14.4%	-25.5%	-25.5%	-25.5%	-31.0%
2040	Total Retail Demand	77.4	77.4	77.4	77.4	77.4	77.4	77.4
	Baseline Retail Demand[c]	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	77.4	66.4	66.4	57.9	57.9	52.0	52.0
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years[b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
	RWS Supply Utilized by Retail[g]	*70.5*	*59.5*	*59.5*	*51.0*	*51.0*	45.1	45.1
	Difference (Supply Surplus or Shortfall)	0.0	-11.0	-11.0	-19.5	-19.5	-24.5	-25.4
	Difference as Percentage of Demand	0.0%	-14.2%	-14.2%	-25.2%	-25.2%	-32.8%	-32.8%
2045	Total Retail Demand	80.6	80.6	80.6	80.6	80.6	80.6	80.6
	Baseline Retail Demand[c]	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	80.6	60.1	60.1	60.1	60.1	52.1	52.1
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	*73.7*	*53.2*	*53.2*	*53.2*	*53.2*	45.2	45.2
	Difference (Supply Surplus or Shortfall)	0.0	-20.5	-20.5	-20.5	-20.5	-28.5	-28.5
	Difference as Percentage of Demand	0.0%	-25.4%	-25.4%	-25.4%	-25.4%	-35.4%	-35.4%

Normal, single dry, and multiple dry year conditions are on a water year basis.

[a] During a single dry year, system-wide shortages of 30 – 40% are in effect (see Table 8-3). For this analysis, shortages greater than 20% are considered to have the same retail/wholesale allocation as the maximum Stage 4, 16-20% system-wide shortage in the WSAP.

[b] During multiple dry years, system-wide shortages of 30 – 55% are in effect (see Table 8-3). For this analysis, shortages greater than 20% are considered to have the same retail/wholesale allocation as the maximum Stage 4, 16-20% system-wide shortage in the WSAP.

[c] Total retail demands correspond to those in Table 4-1, and reflect passive and active conservation, onsite water reuse savings, and water loss. Demands for Groveland CSD is included in the table above. However, in the corresponding standardized tables in Appendix B, Groveland CSD is accounted for as a wholesale customer instead of a retail customer, as explained in Section 2.4.

[d] As amended in 2018, the WSAP Tier One Allocation Plan requires retail customers to conserve a minimum of 5% during droughts. If, during a declared water shortage, retail demands on the Regional Water System are lower than the retail allocation in a dry year, retail demands on the RWS will be reduced by 5%. An N/A on this row means that either this 5% rationing requirement doesn't apply (i.e. no declared water shortage), or retail customers are already rationing greater than 5%.

[e] Groundwater supplies are assumed to be equivalent to projected demands for the San Francisco Groundwater Supply Project (ramping up to 4 mgd by 2040) and Castlewood CSA (0.4 mgd). Groundwater availability would not be affected by dry year conditions.

[f] Recycled water supplies are assumed to be equivalent to projected demands related to the Westside Recycled Water Project (1.6 mgd by 2021 and 1.8 mgd by 2030), Harding Park and Fleming Golf Courses (0.23 mgd), and Sharp Park Golf Course (up to 0.1 mgd) and Treasure Island (0.2 mgd by 2025 and 0.4 mgd by 2030). Recycled water availability would not be affected by dry year conditions.

[g] Procedures for RWS allocations and the WSAP are described in Section 8.3. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, in normal years, if groundwater and recycled water supplies are not available, up to 81 mgd of RWS supply could be used.

Table 8-5. Wholesale Supply and Demand Comparison for Projected Normal and Dry Year Scenarios With Bay-Delta Plan Amendment (mgd)

[Standardized Table 7-2 Wholesale: Normal Year Supply and Demand Comparison]

[Standardized Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison]

[Standardized Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison]

Year	Wholesale Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years [b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2025	Total Wholesale Demand[c]	146.0	146.0	146.0	146.0	146.0	146.0	146.0
	Total Wholesale RWS Supply[d]	146.0	93.3	93.3	80.0	80.0	80.0	80.0
	Difference (Surplus or Shortfall)	0.0	-52.7	-52.7	-66.0	-66.0	-66.0	-66.0
	Difference as % of Demand	0.0%	-36.1%	-36.1%	-45.2%	-45.2%	-45.2%	-45.2%
2030	Total Wholesale Demand[c]	147.9	147.9	147.9	147.9	147.9	147.9	147.9
	Total Wholesale RWS Supply[d]	147.9	94.2	94.2	80.8	80.8	80.8	80.8
	Difference (Surplus or Shortfall)	0.0	-53.7	-53.7	-67.1	-67.1	-67.1	-67.1
	Difference as % of Demand	0.0%	-36.3%	-36.3%	-45.4%	-45.4%	-45.4%	-45.4%
2035	Total Wholesale Demand[c]	151.9	151.9	151.9	151.9	151.9	151.9	151.9
	Total Wholesale RWS Supply[d]	151.9	96.5	96.5	82.7	82.7	82.7	75.8
	Difference (Surplus or Shortfall)	0.0	-55.4	-55.4	-69.2	-69.2	-69.2	-76.1
	Difference as % of Demand	0.0%	-36.5%	-36.5%	-45.6%	-45.6%	-45.6%	-50.1%
2040	Total Wholesale Demand[c]	156.3	156.3	156.3	156.3	156.3	156.3	156.3
	Total Wholesale RWS Supply[d]	156.3	99.2	99.2	85.1	85.1	75.1	75.1
	Difference (Surplus or Shortfall)	0.0	-57.1	-57.1	-71.2	-71.2	-81.2	-81.2
	Difference as % of Demand	0.0%	-36.5%	-36.5%	-45.6%	-45.6%	-52.0%	-52.0%
2045	Total Wholesale Demand[c]	162.8	162.8	162.8	162.8	162.8	162.8	162.8
	Total Wholesale RWS Supply[d]	162.8	88.7	88.7	88.7	88.7	75.4	75.4
	Difference (Surplus or Shortfall)	0.0	-74.1	-74.1	-74.1	-74.1	-87.4	-87.4
	Difference as % of Demand	0.0%	-45.5%	-45.5%	-45.5%	-45.5%	-53.7%	-53.7%

Normal, single dry, and multiple dry year conditions are on a water year basis.

Groveland CSD is not accounted for as a wholesale customer for the purpose of this table. Refer to Table 8-4 for the retail supply and demand comparison including Groveland CSD. However, in the corresponding standardized tables in Appendix B, Groveland CSD is reported as wholesale rather than retail.

a During a single dry year, system-wide shortages of 30 – 40% are in effect (see Table 8-3). For this analysis, shortages greater than 20% are considered to have the same retail/wholesale allocation as the maximum Stage 4, 16-20% system-wide shortage in the WSAP.

b During multiple dry years, system-wide shortages of 30 – 55% are in effect (see Table 8-3). For this analysis, shortages greater than 20% are considered to have the same retail/wholesale allocation as the maximum Stage 4, 16-20% system-wide shortage in the WSAP.

c Total wholesale demands correspond to projected purchase requets shown in Table 4-3. It is assumed that projected Wholesale Customer demands are limited to the Supply Assurance of 184 mgd. The 184 mgd assumes that San Jose and Santa Clara remain temporary, interruptible customers.

d Procedures for RWS allocations and the WSAP are described in Section 8.3.

8.4 WATER SUPPLY AND DEMAND COMPARISONS, WITHOUT BAY-DELTA PLAN AMENDMENT

The following sections summarize the projected retail and wholesale supplies and demands during normal, single dry, and multiple dry years for the scenario without implementation of the Bay-Delta Plan Amendment.

8.4.1 Retail Water Service Reliability Assessment – Without Bay-Delta Plan Amendment

In general, the comparison of retail demands and supplies presented in Table 8-6 demonstrates the following:

- **Normal Years:** During normal hydrologic years, the SFPUC will have adequate supplies to meet its projected retail water demands.
- **Single Dry Year:** During single dry years, there are no anticipated shortages of RWS supplies.
- **Multiple Dry Years:** In the multiple dry year scenario, the SFPUC would only experience shortages in RWS supplies of 10% during years 4 and 5 of an extended drought at 2045 levels of demand. In a 10% shortage, retail customers are allocated 36% of available supplies, which results in a positive allocation to retail (i.e. allocation greater than demand). The allocation above the retail demand level would be re-allocated to the Wholesale Customers, and retail customers would reduce their demands by 5% as required by the WSA.

8.4.2 Wholesale Water Service Reliability Assessment – Without Bay-Delta Plan Amendment

In general, the comparison of wholesale demands and supplies presented in Table 8-7 demonstrates the following:

- **Normal Years:** During normal hydrologic years, the SFPUC will have adequate supplies to meet its projected wholesale water demands.
- **Single Dry Year:** During single dry years, there are no anticipated shortages of RWS supplies.
- **Multiple Dry Years:** In a multiple dry year event, there would only be anticipated shortages in RWS supplies for years 4 and 5 of an extended drought at 2045 levels of demand. In a 10% shortage, the Wholesale Customers are allocated 64% of available supplies, and as described above, they receive any allocation above the retail demands. This would result in a 15% shortage (about 23 mgd) for the Wholesale Customers.

Table 8-6. Retail Supply and Demand Comparison for Projected Normal & Dry Year Scenarios Without Bay-Delta Plan Amendment (mgd)

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years[b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2025	Total Retail Demand	70.7	70.7	70.7	70.7	70.7	70.7	70.7
	Baseline Retail Demand[c]	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	70.7	70.7	70.7	70.7	70.7	70.7	70.7
	Retail Groundwater[e]	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
	Retail Recycled Water[f]	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
	RWS Supply Utilized by Retail[g]	*67.2*	*67.2*	*67.2*	*67.2*	*67.2*	*67.2*	*67.2*
	Difference (Supply Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as Percentage of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2030	Total Retail Demand	72.4	72.4	72.4	72.4	72.4	72.4	72.4
	Baseline Retail Demand[c]	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	72.4	72.4	72.4	72.4	72.4	72.4	72.4
	Retail Groundwater[e]	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*	*2.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	*67.5*	*67.5*	*67.5*	*67.5*	*67.5*	*67.5*	*67.5*
	Difference (Supply Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as Percentage of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2035	Total Retail Demand	74.5	74.5	74.5	74.5	74.5	74.5	74.5
	Baseline Retail Demand[c]	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*	*74.5*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	74.5	74.5	74.5	74.5	74.5	74.5	74.5
	Retail Groundwater[e]	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*	*3.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	*68.6*	*68.6*	*68.6*	*68.6*	*68.6*	*68.6*	*68.6*
	Difference (Supply Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as Percentage of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2040	Total Retail Demand	77.4	77.4	77.4	77.4	77.4	77.4	77.4
	Baseline Retail Demand[c]	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*	*77.4*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	77.4	77.4	77.4	77.4	77.4	77.4	77.4
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	*70.5*	*70.5*	*70.5*	*70.5*	*70.5*	*70.5*	*70.5*
	Difference (Supply Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as Percentage of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years[b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2045	Total Retail Demand	80.6	80.6	80.6	80.6	80.6	76.6	76.6
	Baseline Retail Demand[c]	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*
	WSA 5% Demand Reduction	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*-4.0*	*-4.0*
	Total Retail Supply	80.6	80.6	80.6	80.6	80.6	80.6	80.6
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Utilized by Retail[g]	*73.7*	*73.7*	*73.7*	*73.7*	*73.7*	*73.7*	*73.7*
	Difference (Supply Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	4.0	4.0
	Difference as Percentage of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	5.3%	5.3%

Normal, single dry, and multiple dry year conditions are on a water year basis.

[a] During all single dry years, no RWS system-wide shortages are in effect.

[b] During multiple dry years, no RWS system-wide shortages are in effect until years 4 and 5 at 2045 levels of demand. During those years, a 10% system-wide shortage is in effect.

[c] Total retail demands correspond to those in Table 4-1, and reflect passive and active conservation, onsite water reuse savings, and water loss. Demands from Groveland CSD are included in the table above. However, in the corresponding standardized tables in Appendix B, Groveland CSD is accounted for as a wholesale customer instead of a retail customer, as explained in Section 2.4.

[d] As amended in 2018, the WSAP Tier One Allocation Plan requires retail customers to conserve a minimum of 5% during droughts. If, during a declared water shortage, retail demands on the Regional Water System are lower than the retail allocation in a dry year, retail demands on the RWS will be reduced by 5%. An N/A on this row means that either this 5% rationing requirement doesn't apply (i.e. no declared water shortage), or retail customers are already rationing greater than 5%.

[e] Groundwater supplies are assumed to be equivalent to projected demands for the San Francisco Groundwater Supply Project (ramping up to 4 mgd by 2040) and Castlewood CSA (0.4 mgd). Groundwater availability would not be affected by dry year conditions.

[f] Recycled water supplies are assumed to be equivalent to projected demands related to the Westside Recycled Water Project (1.6 mgd by 2021 and 1.8 mgd by 2030), Harding Park and Fleming Golf Courses (0.23 mgd), and Sharp Park Golf Course (up to 0.1 mgd) and Treasure Island (0.2 mgd by 2025 and 0.4 mgd by 2030). Recycled water availability would not be affected by dry year conditions.

[g] Procedures for RWS allocations and the WSAP are described in Section 8.3. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if groundwater and recycled water supplies are not available, up to 81 mgd of RWS supply could be used.

Table 8-7. Wholesale Supply and Demand Comparison for Projected Normal and Dry Year Scenarios Without Bay-Delta Plan Amendment (mgd)

Year	Wholesale Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years [b]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2025	Total Wholesale Demand[c]	146.0	146.0	146.0	146.0	146.0	146.0	146.0
	Total Wholesale RWS Supply[d]	146.0	146.0	146.0	146.0	146.0	146.0	146.0
	Difference (Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2030	Total Wholesale Demand[c]	147.9	147.9	147.9	147.9	147.9	147.9	147.9
	Total Wholesale RWS Supply[d]	147.9	147.9	147.9	147.9	147.9	147.9	147.9
	Difference (Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2035	Total Wholesale Demand[c]	151.9	151.9	151.9	151.9	151.9	151.9	151.9
	Total Wholesale RWS Supply[d]	151.9	151.9	151.9	151.9	151.9	151.9	151.9
	Difference (Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2040	Total Wholesale Demand[c]	156.3	156.3	156.3	156.3	156.3	156.3	156.3
	Total Wholesale RWS Supply[d]	156.3	156.3	156.3	156.3	156.3	156.3	156.3
	Difference (Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2045	Total Wholesale Demand[c]	162.8	162.8	162.8	162.8	162.8	162.8	162.8
	Total Wholesale RWS Supply[d]	162.8	162.8	162.8	162.8	162.8	139.1	139.1
	Difference (Surplus or Shortfall)	0.0	0.0	0.0	0.0	0.0	-23.7	-23.7
	Difference as % of Demand	0.0%	0.0%	0.0%	0.0%	0.0%	-14.6%	-14.6%

Normal, single dry, and multiple dry year conditions are on a water year basis.

Groveland CSD is not accounted for as a wholesale customer for the purpose of this table. Refer to Table 8-6.

for the retail supply and demand comparison including Groveland CSD. However, in the corresponding standardized tables in Appendix B, Groveland CSD is reported as wholesale rather than retail.

[a] During all single dry years, no RWS system-wide shortages are in effect.

[b] During multiple dry years, no RWS system-wide shortages are in effect until years 4 and 5 at 2045 levels of demand. During those years, a 10% system-wide shortage is in effect.

[c] Total wholesale demands correspond to projected purchase requets shown in Table 4-3. It is assumed that projected Wholesale Customer demands are limited to the Supply Assurance of 184 mgd. The 184 mgd assumes that San Jose and Santa Clara remain temporary, interruptible customers.

[d] Procedures for RWS allocations and the WSAP are described in Section 8.3.

8.5 DROUGHT RISK ASSESSMENT

The SFPUC developed the following Drought Risk Assessment (DRA) in compliance with Water Code Section 10635(b). The analysis presents a methodical assessment of water supplies and water uses under a hypothetical five-year drought scenario that extends from 2021 to 2025.

8.5.1 Data & Methods

The data and methods used to determine the RWS supply for the DRA dry-year sequence are the same as those described in Section 8.2. The SFPUC used the HHLSM model with the design drought sequence to perform the water supply analyses and simulate the water supply shortage conditions over the five-year drought period.

As with the supply reliability assessment, the DRA includes two scenarios, with and without the implementation of the Bay-Delta Plan Amendment, to show the drought conditions under two potential regulatory scenarios that may occur over the 2021-2025 period. The Bay-Delta Plan Amendment implementation scenario considers the implementation of the full Bay-Delta Plan Amendment in 2023.

The DRA takes into consideration the roll-out of recycled water and groundwater supply projects that the SFPUC has planned to be implemented by 2025. In addition, the retail demands for the DRA are based on linear interpolation between the current 2020 retail demands of 68.8 mgd and the projected 2025 retail demands of 70.7, as presented in Section 4.

8.5.2 Basis for Supply Shortage Conditions

The DRA analysis uses 2020 as a base year and considers the current status of the ongoing supply WSIP projects, as shown in Table 8-1.

The anticipated supply availabilities for the five-year drought period were presented above in Table 8-2 and Table 8-3. The overall impacts for the two scenarios are as follows:

- **With Full Implementation of the Bay-Delta Plan Amendment:** In this dry-year sequence, there would not be anticipated reductions in RWS supplies prior to the implementation of the Bay-Delta Plan Amendment in 2023. The RWS supply reductions would reach 40% upon the implementation of the Bay-Delta Plan Amendment in 2023 until the end of the drought sequence in 2025. The split between wholesale and retail customers (see Section 8.2.4) at this shortage level informs the available retail RWS supplies considered in this analysis.

- **Without Implementation of the Bay-Delta Plan Amendment:** Assuming the availability of existing supplies at current demand levels, there are no anticipated reductions in RWS supply.

8.5.3 DRA Water Source Reliability

The DRA takes into account the supplies from the RWS, local groundwater, and local recycled water. The recycled water and groundwater projects that the SFPUC has planned for implementation within the next 5 years are integrated into the available supply portfolio for this five-year drought scenario. The SFPUC plans to increase recycled water supplies from 0.1 mgd in 2021 to 2.1 mgd in 2025, through the implementation of the Westside Recycled Water Project, the Treasure Island Recycled Water Project, and the restoration of the Harding Park Recycled Water Project. It is assumed that the Westside Recycled Water Project will supply approximately 1.3 mgd to Golden Gate Park and Lincoln Park in 2022 and will serve approximately 0.3 mgd to the San Francisco Zoo by 2023. In addition, the groundwater supplies used for irrigation in 2022 will be replaced by recycled water from the Westside Recycled Water Project. The groundwater production from 2022 to 2024 includes the in-city potable use (~0.5 mgd) and the Castlewood well system (~0.4 mgd). The in-City potable groundwater use is assumed to increase from 0.5 mgd to 1 mgd in 2025.

8.5.4 Water Supply and Demand Comparison for 5-Year Drought Sequence

The supply and demand comparisons for the hypothetical drought sequence from 2021 to 2025 are presented below in Table 8-8 and Table 8-9 for scenarios with and without the implementation of the Bay-Delta Plan Amendment, respectively. Where a shortage condition is identified, the tables reflect actions that would be taken in accordance with the Water Shortage Contingency Plan (WSCP), as shown in Appendix K.

With Implementation of the Bay-Delta Plan Amendment. Table 8-8 compares the total water supply sources available with the total projected water demand through the 2021-2025 drought scenario, assuming the full implementation of the Bay-Delta Plan Amendment starting in 2023. As such, the years 2021 and 2022 are not affected by upcoming regulatory changes and show no supply shortfall.

The implementation of the Bay-Delta Plan Amendment in 2023 is expected to result in a 40% shortage of RWS supplies. The WSAP does not address shortages above 20%; therefore, for the purposes of this analysis it was assumed that the 20% shortage allocations would apply for the 40% shortage scenario. Based on this split, starting in the third year of this drought sequence, the retail allocation from the RWS drops to 44.7 mgd. This reduction in RWS supplies for retail would lead to a supply shortfall of up to 32%, or 22.5 mgd in 2024 and 2025. As detailed in the WSCP, the supply shortfall will be addressed through mandatory water use rationing.

Without Implementation of the Bay-Delta Plan Amendment. Table 8-9 compares the total water supply sources available with the total projected water use through this 2021-2025 drought scenario without the Bay-Delta Plan Amendment. Without implementation of the Bay-Delta Plan Amendment, the SFPUC has sufficient supplies to serve its retail demands in the event of a five-year drought starting in 2021.

Table 8-8. Retail Supply and Demand Comparison for Five-Year Drought Risk Assessment – With Bay-Delta Plan Amendment (mgd)

[Standardized Table 7-5 Five-Year Drought Risk Assessment to address Water Code Section 106359b)]

	2021	2022	2023	2024	2025
Gross Water Use[a]	69.2	69.6	69.9	70.3	70.7
Supply Sources					
RWS Supply[b]	66.9	67.3	44.7	44.7	44.7
Groundwater[c]	2.2	0.9	0.9	0.9	1.4
Recycled Water[d]	0.1	1.4	1.7	1.7	2.1
Total Supplies	65.8	66.2	47.3	47.3	48.2
Surplus/(Shortfall) w/o WSCP Action	0.0	0.0	(22.6)	(23.0)	(22.5)
Planned WSCP Actions (use reduction and supply augmentation)					
WSCP - supply augmentation benefit	-	-	-	-	-
WSCP - use reduction savings benefit[f]	-	-	22.6	23.0	22.5
Revised Surplus/(Shortfall)	-	-	0.0	0.0	0.0
Resulting % Use Reduction from WSCP action[e]	-	-	32.4%	32.07	31.8%

a. Total retail demands reflect active and passive conservation, onsite water reuse savings, and water loss and demands are linearly interpolated between 2020 and 2025.
b. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.
c. Assuming that the in-city irrigation groundwater capacity accounts for approximately 1.5 mgd , the in-city potable groundwater use is 0.5 mgd and Castlewood CSA uses 0.3 mgd in 2021. When the Westside Recycled Water Project comes online in 2022 and the irrigation groundwater use is phased out. The groundwater production from 2022 to 2024 assumes 0.5 mgd production for in-city potable use and 0.4 mgd supplied by the Castlewood Well System. The potable groundwater production is anticipated to increase to 1.4 mgd in 2025.
d. Assuming that the Westside Recycled Water Project will provide 1.3 mgd to Golden Gate Park and Lincoln Park by 2022, and 0.3 mgd to the San Francisco Zoo by 2023.
e. The demand rationing actions and respective shortage levels are detailed in the WSCP.

Table 8-9. Retail Supply and Demand Comparison for Five-Year Drought Risk Assessment – Without Bay-Delta Plan Amendment (mgd)

	2021	2022	2023	2024	2025
Gross Water Use[a]	69.2	69.6	69.9	70.3	70.7
Supply Sources					
RWS Supply[b]	66.9	67.3	67.3	67.7	67.2
Groundwater[c]	2.2	0.9	0.9	0.9	1.4
Recycled Water[d]	0.1	1.4	1.7	1.7	2.1
Total Supplies	69.2	69.6	69.9	70.3	70.7
Surplus/(Shortfall) w/o WSCP Action	0	0	0	0	0
Planned WSCP Actions (use reduction and supply augmentation)					
WSCP - supply augmentation benefit	-	-	-	-	-
WSCP - use reduction savings benefit	-	-	-	-	-
Revised Surplus/(Shortfall)	-	-	-	-	-
Resulting % Use Reduction from WSCP action	-	-	-	-	-

a. Total retail demands reflect active and passive conservation, onsite water reuse savings, and water loss and demands are linearly interpolated between 2020 and 2025.

b. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.

c. Assuming that the in-city irrigation groundwater capacity accounts for approximately 1.5 mgd , the in-city potable groundwater use is 0.5 mgd and Castlewood CSA uses 0.3 mgd in 2021. When the Westside Recycled Water Project comes online in 2022 and the irrigation groundwater use is phased out. The groundwater production from 2022 to 2024 assumes 0.5 mgd production for in-city potable use and 0.4 mgd supplied by the Castlewood Well System. The potable groundwater production is anticipated to increase to 1.4 mgd in 2025.

d. Assuming that the Westside Recycled Water Project will provide 1.3 mgd to Golden Gate park and Lincoln Park by 2022, and 0.3 mgd to the San Francisco Zoo by 2023

SECTION 9: WATER SHORTAGE CONTINGENCY PLAN

The Water Shortage Contingency Plan is included as Appendix K.

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SECTION 10: DEMAND MANAGEMENT MEASURES

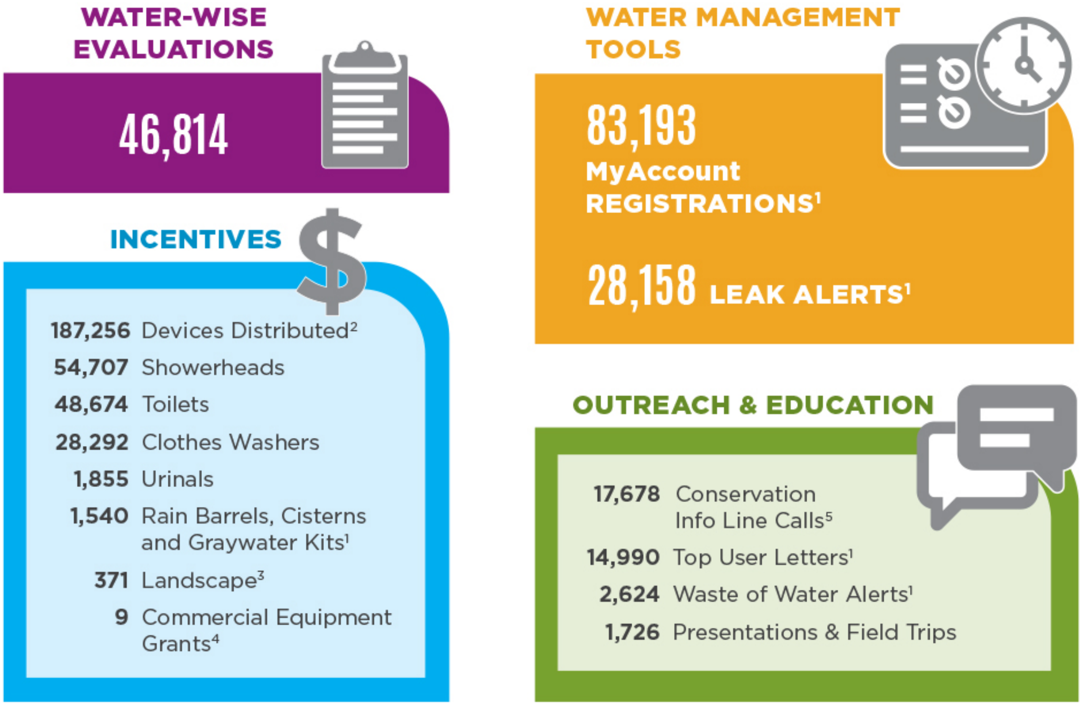
This section describes the SFPUC's efforts to promote conservation and to reduce demand on water supply. Several demand management measures (DMMs)—including metering, public education and outreach, and water conservation program coordination—are addressed.

10.1 RETAIL WATER CONSERVATION PROGRAM

The SFPUC's retail water conservation program has historically consisted of a mix of financial incentives, technical assistance, water management tools, education and outreach, and mandates. These offerings are planned to continue over the next five years and beyond. Between 2005 and 2025, the SFPUC will have evaluated and implemented over 80 different conservation measures and mandates, providing extensive customer water-savings assistance that has played a major role in the significant decline in water use occurring over this period. These include conservation best management practices found successful by major water utilities and efficiency experts across the nation; measures demonstrated by third-party studies to have water savings and customer benefits; and measures that make sense for the site conditions and characteristics unique to San Francisco water use. During its Retail Water Conservation Plan updates in 2011, 2015 and 2020, the SFPUC conducted thorough analyses of all measures in place at the time of each plan, potential new measures not implemented before, and measures previously offered and discontinued.

The SFPUC estimates its conservation program and efficient plumbing codes have a "past savings" of approximately 86,385 AF (28,149 MG or 5.5 mgd) between 2005 (the year the SFPUC developed its first conservation forecast model) and 2019. "Future savings" are estimated at 117,221 AF (38,197 MG or 4.2 mgd) between 2020 and 2045. This estimate does not reflect water savings from conservation measures the SFPUC offers but does not model or from SFPUC efforts that are not part of its conservation program but may generate potable water savings, including its supply-side water loss program. The SFPUC has provided water-saving assistance to many thousands of residential and non-residential customers. Figure 10-1 highlights the SFPUC's water conservation accomplishments between 2010 and 2020.

Figure 10-1. Summary of SFPUC's Water Conservation Achievements



1 Tracking of participation in measure started later than 2009

2 Aerators, toilet flappers, fill valves, pre-rinse spray valves, nozzles, soil moisture meters

3 Landscape includes Water Efficient Irrigation Ordinance projects, landscape audits, community irrigation grants and rebates

4 Includes ice machines, industrial dishwashers, sterilization equipment

5 Doesn't include calls to the SFPUC's Call Center regarding conservation

The SFPUC's conservation measures can be broadly characterized as foundational customer assistance measures and water efficiency mandates that the SFPUC anticipates continuing through the 2045 planning horizon with no definite end date, such as evaluations, site usage reports and tools, free devices, education and outreach, and mandates or incentive-based measures that have specific and varying end dates, depending on factors such as plumbing code impacts and market saturation rates. Collectively, the measures proposed for 2020 and beyond support the SFPUC's strategies for tapping into anticipated remaining water-saving opportunities, specifically:

- Maintaining efficiency among customers, properties and sites that already have water-wise use.
- Improving efficiency among residential customers with over average water use due to leaks, old fixtures, inefficient irrigation, or other forms of water waste.
- Increasing commercial property compliance with requirements for efficient plumbing fixtures and awareness of opportunities for equipment retrofits, reuse technologies, and efficiency audits and action plans.
- Increasing commercial customer awareness of constant and/or abnormally high-water use, with focus on hotels, restaurants, office buildings, and schools that represent the non-residential sectors with the overall highest water use.
- Promoting compliance with new efficiency standards among large landscapes served by dedicated irrigation meters and smaller sites with inefficient irrigation
- Maximizing opportunities for onsite reuse in new development.

Moving forward, the SFPUC will continue to utilize a mix of demand-side, customer water-saving strategies, including voluntary incentives, assistance services, tools to help customers understand and manage their water use, education and outreach, and mandates that require indoor and outdoor water efficiency.

10.2 RETAIL DMMs

The SFPUC's conservation program is now guided by a mix of agency and City policy directives and state and local water efficiency requirements that have evolved over time. On the state level, these requirements have shifted from meeting Best Management Practices (BMPs) to meeting the state per capita water reduction targets set by the Water Conservation Action of 2009 (SB x7-7) to meeting new water efficiency targets mandates by AB 1668 and SB 606 that urban suppliers will need to meet starting in 2023 based on standards for efficient indoor, outdoor water use, and supply side water loss. Locally, San Francisco has adopted state requirements for mandating water-efficient plumbing fixtures, landscapes and irrigation systems, as well as restrictions against outdoor water waste and sub-metering in new multi-family construction. The SFPUC also continues to set its own Level of Service (LOS) goals that promote efficiency and sustainability, including maintaining average residential per capita use under 50 gallons a day. The SFPUC met state BMP goals for the many years they were in effect; is well below its state-imposed SB x7-7 per capita use target for 2020; and is on track to meet California's new efficiency targets.

The SFPUC has been implementing conservation measures for decades. Through the SFPUC's longstanding, intensive efforts to promote conservation and educate San Franciscans and its other retail customers on efficient and appropriate uses of water, San Francisco has had one of the lowest per capita water uses in the State. As stated in Section 4.1, gross and residential per capita consumption by in-City retail water customers are 73 and 42 GPCD, respectively. Taking suburban retail use into account, gross and residential per capita consumption by all retail water customers are 76 and 42 GPCD, respectively.

The SFPUC voluntarily prepares a conservation plan for its retail service area, which includes more details on DMMs planned over the next five to 25 years. The 2020 conservation plan can be viewed on or downloaded from the SFPUC's website at **www.sfpuc.org/learning/conserve-water**.

The SFPUC was a signatory of the California Urban Water Conservation Council (CUWCC)'s Memorandum of Understanding (MOU) for the duration of its existence from 1991 to 2016, agreeing to voluntarily meet and report on conservation BMPs. During that time, the SFPUC implemented conservation measures in accordance with CUWCC BMP compliance goals and met requirements for biannual BMP reporting. In 2016, the CUWCC underwent an organizational transformation and decided to sunset in response to social, economic, environmental, regulatory and political conditions that changed substantially over its 25 years of existence, including passage of California's Water Conservation Act of 2009 mandating a 20 percent reduction in statewide urban per capita water use by 2020 followed by new state water conservation mandates (Executive Order B-37-16) and reporting requirements. In 2017, it relaunched as a new organization, the California Water Efficiency Partnership (CalWEP), dedicated to advancing water efficiency in the state through research, assistance, tools, and education but not through a MOU requiring member compliance with specific BMPs. The SFPUC is a member of CalWEP and continues to implement numerous DMMs in the form of conservation programs, most of which builds from and meet the goals of the last iteration of the CUWCC's foundational and programmatic BMPs.

10.2.1 Water Waste Prevention Ordinances

10.2.1.1 Past Implementation

Permanent water use restrictions were first established in Section E of the SFPUC Rules and Regulations Governing Water Service to Customers. During the 1987-92 drought, the SFPUC enacted numerous additional water use restrictions and prohibitions in response to the severe water shortage. With the end of the drought in 1993, the SFPUC elected to continue certain restrictions to promote long-term conservation. These restrictions are also included as part of the WSCP's water waste prohibitions (see Appendix K).

Violation of any water use restriction may result in the installation of a flow-restricting device in the service line of the customer, and continued violation could result in termination of service. The customer bears the cost of any enforcement action.

Section F of the SFPUC Rules and Regulations Governing Water Service to Customers, which is implemented as part of the City's Water Efficient Irrigation Ordinance, took effect in 2010 and was updated in 2015. Section F establishes water efficient irrigation rules, which prohibit water runoff from landscapes of any size due to low head drainage, overspray, broken irrigation hardware, or other conditions where water flows onto adjacent property, walks, roadways, parking lots, or other structures.

In 2016, the SFPUC adopted expanded permanent water waste restrictions as part of Section E, Rule 12 of its Rules and Regulations Governing Water Service to Customers. These rules restrict the following uses of water:

- Application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots or structures
- Use of hoses for any purpose without a positive shut off valve
- Use of potable water to wash sidewalks, driveways, plazas and other outdoor hardscapes for reasons other than health, safety, or to meet City of San Francisco standards for sidewalk cleanliness (per the Department of Public Works Streets and Sidewalks Maintenance Manual as required by City Charter Section F, 102) and in a non-water-efficient manner that causes runoff to storm drains and sewer catch basins
- Use of single-pass cooling systems, fountains, decorative water features, and commercial car washes
- Application of potable water to outdoor landscapes during and within 48 hours after measurable rainfall
- Irrigation with potable water of ornamental turf on public street medians
- Use of potable water for consolidation of backfill, dust control, or other nonessential construction purposes if foundation drainage or recycled water is available and approved by the Department of Public Health
- Serving drinking water other than upon request at eating or drinking establishments, including restaurants, hotels, cafes, cafeterias, bars or other public places where food or drink are served
- To promote conservation, hotels and motels shall provide guests with the option of choosing not to have towels and linens laundered daily and display notice of this option in guestrooms

Members of the public are encouraged to report incidents of water waste online or by phone through the City of San Francisco's 311 system, and the SFPUC Water Conservation Section investigates and responds to all reports.

10.2.1.2 Planned Implementation

The SFPUC will continue to implement the water use restrictions and water efficient irrigation rules in its Rules and Regulations Governing Water Service to Customers and continue to monitor and respond to public reports of water waste.

10.2.2 Metering

10.2.2.1 Past Implementation

All in-City retail customers have been metered since 1916 and are billed by volume. All suburban retail customers are also fully metered and are billed by volume. There are approximately 181,000 existing water meters in the City and approximately 225 in the suburban retail service area.

By 2018, the SFPUC completed substantial deployment of its Automated Water Meter Program to upgrade in-City and suburban retail water meters with wireless advanced metering technology. The SFPUC was the first major water utility in the State to implement a system of this scale. As of 2020, 99% of retail system meters are automated.

The automated water meter reading system enabled the launch of tools to help monitor customer water use and identify potential high or unusual usage: My Account and the Leak Alert Program. My Account, a bill management system and web portal for viewing water use, was launched in May 2014 and upgraded since and allows customers to view their hourly and daily water use data provided by the automated water meter reading system. The SFPUC also launched a Leak Detection Program in April 2015 to notify single family residential customers about potential plumbing leaks that may be occurring at their homes. Since then, the SFPUC has expanded its program to include multi-family, commercial and irrigation account customers. Hourly water consumption data collected through the automated water meter reading system are analyzed, and if continuous water use is observed, automated courtesy alerts via email, text message, phone message and letter are sent to the account holder, property owner and site occupant.

Existing sub-metering requirements are established in the San Francisco Green Building Code and Section F of the SFPUC Rules and Regulations Governing Water Service to Customers. Per the Green Building Code, new non-residential buildings must install a separate sub-meter for each individual building tenant that would consume more than 1,000 gallons per day. For new non-residential buildings over 50,000 square feet, a sub-meter must be installed for each tenant that consumes more than 100 gallons per day. Section F of the SFPUC Rules and Regulations Governing Water Service to Customers, which is implemented as part of the Water Efficient Irrigation Ordinance, requires dedicated irrigation meters for landscape areas greater than 5,000 square feet. In 2016, California passed Senate Bill 7 (SB 7), which requires new multi-family residential buildings in California constructed after January 1, 2018 to include a submeter for each dwelling unit and to bill tenants in apartment buildings accordingly for their water use. In response, the SFPUC, in coordination with the San Francisco Department of Building Inspection (DBI) and Department of Public Health (DPH), began requiring proof of sub-metering before approving requests for water service from new multi-family residential buildings.

10.2.2.2 Planned Implementation

Replacement of a small number of remaining old meters is ongoing. The SFPUC will be continuing and expanding its Leak Alert Program.

10.2.3 Conservation Pricing

10.2.3.1 Past Implementation

For many years, the SFPUC has used conservation pricing as an incentive to conserve water. To promote the installation of efficient plumbing fixtures, the SFPUC implemented an incentive rate structure for its retail customers. Under the four-year rate schedule for FY2018-2019 through FY 2021-2022, water rates for both single family and multi-family residential accounts were set with a two-tier increasing block rate structure, where the Tier 1 threshold was 4 CCF for single family and 3 CCF for multi-family. Non-residential (i.e., commercial) water rates were set with a uniform rate structure. Water rates across all customer sectors were scheduled to increase annually.

The rate schedule also addresses violation of water use restrictions. Violations may result in the installation of flow-restricting devices, and continued violation may result in discontinuance of water service. The costs of these actions are borne by the customer.

The SFPUC's current rate schedule, effective for FY 2018-2019 through FY2021-2021, may be accessed at: . **www.sfpuc.org/accounts-services/water-power-and-sewer-rates**.

10.2.3.2 Planned Implementation

The current rate schedule is in effect through FY2021-2022. The SFPUC conducts an independent rate study every four to five years to inform the next rate schedule.

10.2.4 Public Education and Outreach

10.2.4.1 Past Implementation

Throughout the year, the SFPUC markets its conservation services and assistance measures through numerous means, including social media, digital and print newsletters, bill inserts, email blasts, direct mailings, local media and trade publications, and its website. For example, the SFPUC periodically contacts top residential water users to encourage them to improve efficiency, alert them to the possibility of plumbing leaks, and offer free Water Wise Evaluations. The SFPUC's newsletters issued in print and digitally to customers and stakeholders almost always feature a conservation-related article or water-saving tips in each issue.

The SFPUC also participates in community events and presentations that reach residents and businesses, as well as events that target specific audiences and industry trade groups. Water conservation staff, along with education partners, conduct in-class and virtual (during the COVID pandemic) presentations during the school year. Program offerings are aligned with State curriculum standards, and many focus on providing placed-based or outdoor learning opportunities to supplement students' classroom work. The SFPUC also participates in local festivals, street fair events, and community presentations. The SFPUC offers a variety of free teacher resources, including guides, lesson plans, fact sheets and activity sheets. The SFPUC maintains and offers public access and organized adult and youth programming at several demonstration gardens that promote water-efficient gardening and irrigation practices.

Below is a summary of some of the key educational and outreach activities conducted between FY 2015-2016 and FY 2019-2020.

Table 10-1. Summary of SFPUC Retail Educational and Outreach Activities Over Five Years (Conducted between FY15-16 and FY19-20)

Activity	Total
School Presentations & Field Trips	374
Community Events, & Presentations	209
Conservation Information Line Calls	13,441
Waste of Water Reports	1,383
Leak Incidents Notified by Alerts	28,158
Top User Letters	5,788
MyAccount Online Portal Users	Over 86,000 customers

10.2.4.2 Planned Implementation

The SFPUC plans to continue conducting a wide range of public education and outreach efforts over the next five years and beyond to promote water efficiency among residents, businesses and customers.

10.2.5 Management of System Losses

10.2.5.1 Past Implementation

The SFPUC controls system losses primarily through asset and leak management. The SFPUC's Linear Assets Management Program replaces and renews distribution system pipelines and customer service connections for approximately 1,250 miles of drinking water mains in the City. Planning analysis has demonstrated an annual pipeline improvement rate of 15 miles per year is needed to meet customer Level of Service goals for uninterrupted service. Improvements include replacement, rehabilitation, re-lining, and cathodic protection of all pipe size categories to extend or renew pipeline useful life.

A renew service program renews assets at the end of their useful life between the water main and the customer's service connection. These assets include 1-inch to 8-inch diameter service pipes made of cast iron, galvanized steel, and plastic, to be replaced with copper or ductile iron; broken meter boxes; outdated or undersized meters and associated piping; and subsequent associated sidewalk and roadway restoration.

The SFPUC's proactive leak management employs acoustic leak detection to accurately pinpoint leaks in mains of all material types. In addition, the SFPUC prioritizes leak repairs to meet Level of Services goals for uninterrupted service and to reduce real water losses.

The SFPUC also collects and compiles main break data throughout its system. A study analyzed historic main break data to determine what types of pipes are statistically prone to failure due to natural causes. A geographical hot-spot analysis was also conducted to identify areas in the City that are especially prone to high occurrences of main breaks. This information is used to target high risk pipes for prioritized replacement or improvement.

In addition, the SFPUC's Automated Water Meter Program (described previously in Section 10.2.2) enables improved management of system losses.

10.2.5.2 Planned Implementation

The SFPUC is developing a Water Loss Control Master Plan to reduce water loss and to comply with California Senate Bill 555 (SB 555), Water Loss Management.

10.2.6 Water Conservation Program

10.2.6.1 Past Implementation

The SFPUC Water Conservation Section has 13 full-time time staff under the direction of a Water Conservation Section Manager. Conservation staff coordinate implementation of various residential, landscape, and CII conservation programs. The SFPUC's retail water conservation program consists of an extensive mix of measures, including incentives, services, and educational assistance. Incentives include rebates for high-efficiency fixtures, free toilets and installations for qualifying customers, discounts for graywater and rainwater systems, grants for large landscape irrigation efficiency improvements, and free efficient devices. Services include conservation surveys, landscape plan review, and school education programs. The SFPUC also provides a host of tools to help customers understand and manage their water use, including the previously mentioned My Account feature, leak alerts, and a bill adjustment program for leak repair. Below is a summary of key activities accomplished between FY 2015-2016 and FY 2019-2020.

Table 10-2. Summary of Key Water Conservation Programs Over Five Years (Conducted between FY15-16 and FY19-20)

Activity	Total
Surveys	15,409
Toilet Installations	4,326
Toilet Rebates	8,765
Washer Rebates	4,579
Urinal Rebate / Installations	642
Showerheads Distributed	15,884
Landscape and Irrigation Meter Grants	19
Laundry-to-Landscape Kit Discounts	37
Rain Barrel Discounts	1,330
Cistern Discounts	64
Water-Saving Devices Distributed	44,119

10.2.6.2 Planned Implementation

The SFPUC will continue to evaluate and adapt its conservation measures to respond to changing conditions and regulations. This dynamic approach to conservation has contributed to significant reductions in water demand, despite population growth. Moving forward, the SFPUC will continue to utilize a mix of demand-side, customer water-saving strategies, including voluntary incentives, assistance services, tools to help customers understand and manage their water use, education and outreach, and mandates that require indoor and outdoor water efficiency. Foundational customer assistance measures will continue to include water evaluation surveys, site usage reports and tools, free devices, landscape water budgets, and public education and outreach. Fixture incentive measures will continue to include toilets, clothes washers, rainwater barrels and cisterns, residential outdoor graywater system parts, and large commercial equipment over the next five years. Several new incentives are planned to launch within the next five years, including rebates for residential on-demand recirculating hot water pumps and weather-based irrigation controllers.

10.2.7 Other DMMs

In addition to DMMs administered through its water conservation section, the SFPUC also implements several other programs expected to contribute to potable water savings. These include its onsite reuse program that requires new construction over a certain size to use available graywater, rainwater, and foundation drainage for toilet and urinal flushing and irrigation; its stormwater management program that mandates and incentivizes use of rainwater for irrigation; and a high bill adjustment and water and sewer lateral insurance program that may reduce water waste through faster leak repair.

10.3 WHOLESALE DMMs

As described in Section 5.3, BAWSCA coordinates water conservation programs and services for its member agencies. Under the terms of the WSA, the SFPUC cannot provide direct financial assistance for conservation programs to a single Wholesale Customer. For details about BAWSCA-coordinated conservation measures provided in the SFPUC's wholesale service area, visit **https://bawsca.org**. However, the SFPUC's past and planned implementation of wholesale DMMs, to the extent allowed under the WSA, are described below.

10.3.1 Metering

10.3.1.1 Past Implementation

The SFPUC's wholesale customers are fully metered. Approximately 91% of wholesale meters were outfitted with a wireless transmitter so they can transmit hourly water consumption through a cellular endpoint that does not require a fixed network infrastructure. The water consumption is analyzed and recorded in advanced metering software, allowing SFPUC and its wholesale customers to view hourly and daily water consumption rather than waiting for a monthly billing meter read. The software also provides custom alerts for issues in the system or unusual consumption patterns, such as leaks.

10.3.1.2 Planned Implementation

SFPUC's ongoing preventative maintenance program ensures that the meters are regularly inspected, maintained and calibrated. The SFPUC is currently in the process of evaluating the calibration, maintenance and replacement procedures of the wholesale meters and will update the current practices of the annual meter calibration program.

10.3.2 Public Education and Outreach

The SFPUC provides technical and administrative assistance for public information and school education to its Wholesale Customers as requested. The last such assistance was a regional drought awareness marketing and media campaign that covered some of Wholesale Customers' service areas that started in 2014 and continued into 2017.

10.3.3 Water Conservation Program Coordination and Staffing Support

As previously described in Section 5.3, BAWSCA manages a Regional Water Conservation Program (see http://bayareaconservation.org) and represents the interests of the Wholesale Customers. The program is composed of several different conservation measures and is designed to support and augment its member agencies' customer efforts to use water more efficiently.

Under the terms of the WSA with its Wholesale Customers, the SFPUC cannot provide direct financial assistance for conservation programs to an individual Wholesale Customer and add this expense to the wholesale revenue requirement for that year. The SFPUC can provide staff to assist Wholesale Customer conservation efforts and, through agreement with BAWSCA, can develop service area-wide conservation programs that can be funded as a joint expense by its retail customers and Wholesale Customers.

10.3.4 Asset Management

The SFPUC initiated a Pipeline Inspection Program in the early 1990s for the 350 miles of water transmission lines in the RWS. Routine inspections are considered preventive maintenance measures, but they also provide information on pipeline leaks. These inspections are usually conducted year-round with no more than one section of a major pipeline out of service at any time. The Pipeline Inspection Program covers the entire water transmission system over a 20-year period and then repeats. The SFPUC has a goal to inspect one section per quarter, averaging 10 to 12 miles per year. In 2018 and 2019, 13 and 12 miles of pipe were inspected, respectively. Due to the COVID-19 pandemic, the rate of inspection decreased in 2020 (approximately 3.6 miles), and is expected to return to normal in 2021. Technically, the RWS does not have any distribution system components, only transmission system components. In addition to inspections, SFPUC staff also regularly compare production volumes with customer consumption to help identify the leakage rate.

10.3.4.1 Past Implementation

The major focus of asset management for the wholesale system in the past decade has been the WSIP. To date, the program is at approximately 96% completion. Within the last five years, system improvements included significant pipeline and tunnel construction, rehabilitation and replacement. Since 2016, the completed WSIP projects include the completion of the new 3.52 mile-long steel-lined Irvington Tunnel (now IT2), the implementation of seismic upgrades and pipeline improvements along the BDPL Nos. 3 and 4, the completion of the new 5-mile long steel-line Bay Tunnel under the San Francisco Bay, and targeted pipeline replacements and seismic upgrades along the San Andreas Pipeline Nos. 2 and 3, and the Sunset Supply Pipeline. The implemented improvements provide additional system redundancy, increased system capacity and improved seismic resiliency. Two additional major projects were completed within the last five years, which included key seismic upgrades, such as the addition of isolation valves and the upgrade of existing appurtenances, and pipeline replacements along the San Andreas Pipeline No.2.

10.3.4.2 Planned Implementation

Major pipeline rehabilitation and replacement projects are planned within the next 5 to 10 years. Key pipeline replacements will be implemented along the Crystal Springs Pipeline No.2, which will involve the replacement of welded steel pipe, the replacement of coal tar lining, the addition of new access manholes and isolation valves, and improvements to appurtenances. The SFPUC also plans to conduct internal lining repairs (removing corrosion accumulation at pipe joints and spalled mortar lining, cleaning metal surfaces, applying new mortar lining, and cleaning debris and sediment found inside the pipe) at the Bay Division Pipeline Nos 1-4 and will implement targeted repairs, rehabilitation or replacement of the pre-stressed concrete pipe of the Bay Division Pipeline No.4, as needed. Sections of the Bay Division Pipelines Nos. 3 and 4 will be relocated in the Santa Clara area.

During implementation of the WSIP, about half of the wholesale system transmission pipelines were replaced. The transmission lines that were not replaced under the WSIP are subject to a prioritization program based on findings from the Pipeline Inspection Program and additional factors such as material type, age, redundancy, leak history, and water quality issues. The program is informed by ongoing inspections to determine when pipelines need to be replaced and the SFPUC has been focusing on unmanned-type inspections. As part of the Safe Pipeline Entry Program, the SFPUC initiated considering the installation of additional valves to be included as part of pipeline replacement projects.

10.3.5 Assistance to Wholesale Customers

BAWSCA is the only entity of its kind to have authority to perform regional water supply reliability planning for its member agencies. Among other services, it also has the authority to coordinate water conservation programs and services for its member agencies. BAWSCA manages a Regional Water Conservation Program that is composed of several different conservation measures and is designed to support and augment its member agencies' customer efforts to use water more efficiently. These efforts include the administration of several regional water conservation measures, including measures designed to educate member agency customers about water-efficient landscaping and incentivize irrigated turf removal.

As previously stated, under the terms of the WSA with its Wholesale Customers, the SFPUC cannot provide direct financial assistance for conservation programs to an individual Wholesale Customer and subsequently adds this expense to the wholesale revenue requirement for that year. The SFPUC can provide staff to assist Wholesale Customer conservation efforts and, through agreement with BAWSCA, can develop service area-wide conservation programs that can be funded as a joint expense by its retail customers and Wholesale Customers. To this end, the SFPUC works closely with BAWSCA as opportunities arise to jointly develop outreach and communications related to the RWS and conservation. Refer to Section 10.3.2 for information on the SFPUC's collaborative efforts with BAWSCA on public education and outreach efforts. The SFPUC also provides technical and administrative assistance to the Wholesale Customers on preparing information to the public as requested.

SECTION 11: PLAN ADOPTION AND UWMP CHECKLIST

This section describes the adoption, submittal, and implementation of this 2020 UWMP. A checklist is also provided to facilitate DWR's review of the 2020 UWMP.

11.1 PLAN ADOPTION, SUBMITTAL, AND IMPLEMENTATION

The SFPUC prepared this draft 2020 UWMP and will present it to the SFPUC Commission for adoption at a regular meeting in June 2021. A copy of the SFPUC resolution adopting this 2020 UWMP update is provided in Appendix L.

Within 30 days of SFPUC Commission approval, the adopted 2020 UWMP will be submitted electronically to the DWR via its Water Use Efficiency data online submittal tool (WUEdata). Electronic copies will also be provided on compact disc to the California State Library and via e-mail to cities and counties within which the SFPUC provides water. The SFPUC will implement the adopted 2020 UWMP in accordance with the California Urban Water Management Planning Act.

Following adoption, the SFPUC will continue to implement water supply planning programs and projects identified in this 2020 UWMP, including those related to conservation, groundwater, recycled water, and Alternative Water Supply Planning.

11.2 UWMP CHECKLIST

The UWMP 2020 checklist is provided in Appendix M to facilitate DWR's review of the completeness of this document and is organized by subject matter. In addition, complete sets of standardized tables and SB X7-7 Verification Form tables prescribed by DWR are provided in Appendices B and D, respectively.

2020
URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

APPENDICES

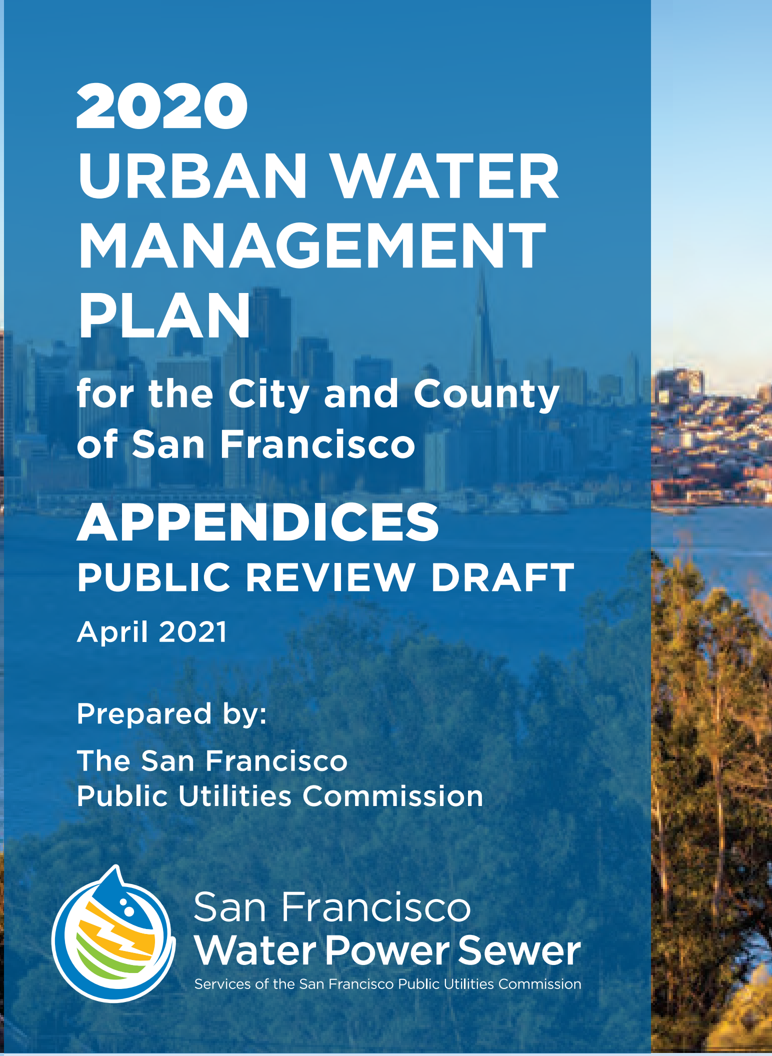
PUBLIC REVIEW DRAFT

April 2021

Prepared by:

The San Francisco
Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission



Urban Water Management Planning Act, Water Code Division 6, Part 2.6

All Codes have been updated to include the 2020 Statues, as of January 1, 2020.

PART 2.6. URBAN WATER MANAGEMENT PLANNING [10610 – 10657]

CHAPTER 1. General Declaration and Policy [10610 – 10610.4]

10610. This part shall be known and may be cited as the "Urban Water Management Planning Act."

10610.2. (a) The Legislature finds and declares all of the following:

(1) The waters of the state are a limited and renewable resource subject to ever-increasing demands.

(2) The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level.

(3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate, and increasing long-term water conservation among Californians, improving water use efficiency within the state's communities and agricultural production, and strengthening local and regional drought planning are critical to California's resilience to drought and climate change.

(4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years now and into the foreseeable future, and every urban water supplier should collaborate closely with local land-use authorities to ensure water demand forecasts are consistent with current land-use planning.

(5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.

(6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require specific water quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.

(7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.

(8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.

(9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.

(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

10610.4. The Legislature finds and declares that it is the policy of the state as follows:

(a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.

(b) The management of urban water demands and efficient use of urban water supplies shall be a guiding criterion in public decisions.

(c) Urban water suppliers shall be required to develop water management plans to achieve the efficient use of available supplies and strengthen local drought planning.

CHAPTER 2. Definitions [10611 – 10618]

10611. Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

10611.3. “Customer” means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

10611.5. “Demand management” means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies.

10612. “Drought risk assessment” means a method that examines water shortage risks based on the driest five-year historic sequence for the agency’s water supply, as described in subdivision (b) of Section 10635.

10613. "Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

10614. "Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.

10615. "Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.

10616. "Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.

10616.5. "Recycled water" means the reclamation and reuse of wastewater for beneficial use.

10617. "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

10617.5. “Water shortage contingency plan” means a document that incorporates the provisions detailed in subdivision (a) of Section 10632 and is subsequently adopted by an urban water supplier pursuant to this article.

10618. “Water supply and demand assessment” means a method that looks at current year and one or more dry year supplies and demands for determining water shortage risks, as described in Section 10632.1.

CHAPTER 3. Urban Water Management Plans

ARTICLE 1. General Provisions [10620 – 10621]

10620. (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).

(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

(c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.

(d) (1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation, efficient water use, and improved local drought resilience.

(2) Notwithstanding paragraph (1), each urban water supplier shall develop its own water shortage contingency plan, but an urban water supplier may incorporate, collaborate, and otherwise share information with other urban water suppliers or other governing entities participating in an areawide, regional, watershed, or basinwide urban water management plan, an agricultural management plan, or groundwater sustainability plan development.

(3) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

(e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.

(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

10621. (a) Each urban water supplier shall update its plan at least once every five years on or before July 1, in years ending in six and one, incorporating updated and new information from the five years preceding each update.

(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.

(c) An urban water supplier regulated by the Public Utilities Commission shall include its most recent plan and water shortage contingency plan as part of the supplier's general rate case filings.

(d) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).

(e) Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.

(f) Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.

ARTICLE 2. Contents of Plans [10630 – 10634]

10630. It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied, while accounting for impacts from climate change.

10630.5. Each plan shall include a simple lay description of how much water the agency has on a reliable basis, how much it needs for the foreseeable future, what the agency's strategy is for meeting its water needs, the challenges facing the agency, and any other information necessary to provide a general understanding of the agency's plan.

10631. A plan shall be adopted in accordance with this chapter that shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other social, economic, and demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available. The description shall include the current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning. Urban water suppliers shall coordinate with local or regional land use authorities to determine the most appropriate land use information, including, where appropriate, land use information obtained from local or regional land use authorities, as developed pursuant to Article 5 (commencing with Section 65300) of Chapter 3 of Division 1 of Title 7 of the Government Code.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a), providing supporting and related information, including all of the following:

(1) A detailed discussion of anticipated supply availability under a normal water year, single dry year, and droughts lasting at least five years, as well as more frequent and severe periods of drought, as described in the drought risk assessment. For each source of water supply, consider any information pertinent to the reliability analysis conducted pursuant to Section 10635, including changes in supply due to climate change.

(2) When multiple sources of water supply are identified, a description of the management of each supply in correlation with the other identified supplies.

(3) For any planned sources of water supply, a description of the measures that are being undertaken to acquire and develop those water supplies.

(4) If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information:

(A) The current version of any groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720), any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management for basins underlying the urban water supplier's service area.

(B) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater.

For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For a basin that has not been adjudicated, information as to whether the department has identified the basin as a high- or medium-priority basin in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to coordinate with groundwater sustainability agencies or groundwater management agencies listed in subdivision (c) of Section 10723 to maintain or achieve sustainable groundwater conditions in accordance with a groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720).

(C) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(D) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(d) (1) For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following: (A) Single-family residential.

(B) Multifamily. (C)

Commercial. (D)

Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(J) Distribution system water loss.

(2) The water use projections shall be in the same five-year increments described in subdivision (a).

(3) (A) The distribution system water loss shall be quantified for each of the five years preceding the plan update, in accordance with rules adopted pursuant to Section 10608.34.

(B) The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association.

(C) In the plan due July 1, 2021, and in each update thereafter, data shall be included to show whether the urban retail water supplier met the distribution loss standards enacted by the board pursuant to Section 10608.34.

(4) (A) Water use projections, where available, shall display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following:

(i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.

(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

(e) Provide a description of the supplier’s water demand management measures. This description shall include all of the following:

(1) (A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measures that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.

(B) The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:

(i) Water waste prevention ordinances.

(ii) Metering.

(iii) Conservation pricing.

(iv) Public education and outreach.

(v) Programs to assess and manage distribution system real loss.

(vi) Water conservation program coordination and staffing support.

(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day, including innovative measures, if implemented.

(2) For an urban wholesale water supplier, as defined in Section 10608.12, a narrative description of the items in clauses (ii), (iv), (vi), and (vii) of subparagraph (B) of paragraph (1), and a narrative description of its distribution system asset management and wholesale supplier assistance programs.

(f) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use, as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in normal and single-dry water years and for a period of drought lasting five consecutive water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(g) Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.

(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five- year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

10631.1. (a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.

(b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under Section 65589.7 of the Government Code to grant a priority for the provision of service to housing units affordable to lower income households.

10631.2. (a) In addition to the requirements of Section 10631, an urban water management plan shall include any of the following information that the urban water supplier can readily obtain:

(1) An estimate of the amount of energy used to extract or divert water supplies.

(2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.

(3) An estimate of the amount of energy used to treat water supplies. (4) An estimate of the

amount of energy used to distribute water

supplies through its distribution systems.

(5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.

(6) An estimate of the amount of energy used to place water into or withdraw from storage.

(7) Any other energy-related information the urban water supplier deems appropriate.

(b) The department shall include in its guidance for the preparation of urban water management plans a methodology for the voluntary calculation or estimation of the energy intensity of urban water systems. The department may consider studies and calculations conducted by the Public Utilities Commission in developing the methodology.

(c) The Legislature finds and declares that energy use is only one factor in water supply planning and shall not be considered independently of other factors.

10632. (a) Every urban water supplier shall prepare and adopt a water shortage contingency plan as part of its urban water management plan that consists of each of the following elements:

(1) The analysis of water supply reliability conducted pursuant to Section 10635.

(2) The procedures used in conducting an annual water supply and demand assessment that include, at a minimum, both of the following:

(A) The written decision making process that an urban water supplier will use each year to determine its water supply reliability.

(B) The key data inputs and assessment methodology used to evaluate the urban water supplier’s water supply reliability for the current year and one dry year, including all of the following:

(i) Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.

(ii) Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The annual supply and demand assessment may consider more than one dry year solely at the discretion of the urban water supplier.

(iii)Existing infrastructure capabilities and plausible constraints.

(iv)A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment.

(v) A description and quantification of each source of water supply.

(3) (A) Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events.

(B) An urban water supplier with an existing water shortage contingency plan that uses different water shortage levels may comply with the requirement in subparagraph (A) by developing and including a cross- reference relating its existing categories to the six standard water shortage levels.

(4) Shortage response actions that align with the defined shortage levels and include, at a minimum, all of the following:

(A) Locally appropriate supply augmentation actions. (B) Locally appropriate demand reduction actions to adequately respond to shortages.

(C) Locally appropriate operational changes.

(D) Additional, mandatory prohibitions against specific water use practices that are in addition to state- mandated prohibitions and appropriate to the local conditions.

(E) For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

(5) Communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding, at a minimum, all of the following:

(A) Any current or predicted shortages as determined by the annual water supply and demand assessment described pursuant to Section 10632.1.

(B) Any shortage response actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1.

(C) Any other relevant communications.

(6) For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption procedures for triggered shortage response actions as determined pursuant to Section 10632.2.

(7) (A) A description of the legal authorities that empower the urban water supplier to implement and enforce its shortage response actions specified in paragraph (4) that may include, but are not limited to, statutory authorities, ordinances, resolutions, and contract provisions.

(A) A statement that an urban water supplier shall declare a water shortage emergency in accordance with Chapter 3 (commencing with Section 350) of Division 1.

(B) A statement that an urban water supplier shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

(8) A description of the financial consequences of, and responses for, drought conditions, including, but not limited to, all of the following:

(A) A description of potential revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(B) A description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(C) A description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1.

(9) For an urban retail water supplier, monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements.

(10) Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed.

(b) For purposes of developing the water shortage contingency plan pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

(c) The urban water supplier shall make available the water shortage contingency plan prepared pursuant to this article to its customers and any city or county within which it provides water supplies no later than 30 days after adoption of the water shortage contingency plan.

10632.1. An urban water supplier shall conduct an annual water supply and demand assessment pursuant to subdivision (a) of Section 10632 and, on or before July 1 of each year, submit an annual water shortage assessment report to the department with information for anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier’s water shortage contingency plan. An urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by July 1 of each year, whichever is later.

10632.2. An urban water supplier shall follow, where feasible and appropriate, the prescribed procedures and implement determined shortage response actions in its water shortage contingency plan, as identified in subdivision (a) of Section 10632, or reasonable alternative actions, provided that descriptions of the alternative actions are submitted with the annual water shortage assessment report pursuant to Section 10632.1. Nothing in this section prohibits an urban water supplier from taking actions not specified in its water shortage contingency plan, if needed, without having to formally amend its urban water management plan or water shortage contingency plan.

10632.3. It is the intent of the Legislature that, upon proclamation by the Governor of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions, the board defer to implementation of locally adopted water shortage contingency plans to the extent practicable.

10632.5. (a) In addition to the requirements of paragraph (3) of subdivision (a) of Section 10632, beginning January 1, 2020, the plan shall include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities.

(b) An urban water supplier shall update the seismic risk assessment and mitigation plan when updating its urban water management plan as required by Section 10621.

(c) An urban water supplier may comply with this section by submitting, pursuant to Section 10644, a copy of the most recent adopted local hazard mitigation plan or multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multihazard mitigation plan addresses seismic risk.

10633. The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier’s service area, and shall include all of the following:

(a) A description of the wastewater collection and treatment systems in the supplier’s service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(c) A description of the recycled water currently being used in the supplier’s service area, including, but not limited to, the type, place, and quantity of use.

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier’s service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.

(g) A plan for optimizing the use of recycled water in the supplier’s service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

10634. The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

CHAPTER 3. Urban Water Management Plans

ARTICLE 2.5. Water Service Reliability [10635]

10635. (a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

(b) Every urban water supplier shall include, as part of its urban water management plan, a drought risk assessment for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the urban water management plan. The urban water supplier may conduct an interim update or updates to this drought risk assessment within the five-year cycle of its urban water management plan update. The drought risk assessment shall include each of the following:

(1) A description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts five consecutive water years, starting from the year following when the assessment is conducted.

(2) A determination of the reliability of each source of supply under a variety of water shortage conditions. This may include a determination that a particular source of water supply is fully reliable under most, if not all, conditions.

(3) A comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.

(4) Considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.

(d) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

(e) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(f) Nothing in this article is intended to change existing law concerning an urban water supplier’s obligation to provide water service to its existing customers or to any potential future customers.

ARTICLE 3. Adoption and Implementation of Plans [10640 – 10645]

10640. (a) Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630). The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

(b) Every urban water supplier required to prepare a water shortage contingency plan shall prepare a water shortage contingency plan pursuant to Section 10632. The supplier shall likewise periodically review the water shortage contingency plan as required by paragraph

(10) of subdivision (a) of Section 10632 and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

10641. An urban water supplier required to prepare a plan or a water shortage contingency plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of both the plan and the water shortage contingency plan. Prior to adopting either, the urban water supplier shall make both the plan and the water shortage contingency plan available for public inspection and shall hold a public hearing or hearings thereon. Prior to any of these hearings, notice of the time and place of the hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies. Notices by a local public agency pursuant to this section shall be provided pursuant to Chapter 17.5 (commencing with Section 7290) of Division 7 of Title 1 of the Government Code. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing or hearings, the plan or water shortage contingency plan shall be adopted as prepared or as modified after the hearing or hearings.

10643. An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

10644. (a) (1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

(2) The plan, or amendments to the plan, submitted to the department pursuant to paragraph (1) shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.

(b) If an urban water supplier revises its water shortage contingency plan, the supplier shall submit to the department a copy of its water shortage contingency plan prepared pursuant to subdivision (a) of Section 10632 no later than 30 days after adoption, in accordance with protocols for submission and using electronic reporting tools developed by the department.

(c) (1) (A) Notwithstanding Section 10231.5 of the Government Code, the department shall prepare and submit to the Legislature, on or before July 1, in the years ending in seven and two, a report summarizing the status of the plans and water shortage contingency plans adopted pursuant to this part. The report prepared by the department shall identify the exemplary elements of the individual plans and water shortage contingency plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan and water shortage contingency plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans and water shortage contingency plans submitted pursuant to this part.

(B) The department shall prepare and submit to the board, on or before September 30 of each year, a report summarizing the submitted water supply and demand assessment results along with appropriate reported water shortage conditions and the regional and statewide analysis of water supply conditions developed by the department. As part of the report, the department shall provide a summary and, as appropriate, urban water supplier specific information regarding various shortage response actions implemented as a result of annual supplier-specific water supply and demand assessments performed pursuant to Section 10632.1.

(C) The department shall submit the report to the Legislature for the 2015 plans by July 1, 2017, and the report to the Legislature for the 2020 plans and water shortage contingency plans by July 1, 2022.

(2) A report to be submitted pursuant to subparagraph (A) of paragraph (1) shall be submitted in compliance with Section 9795 of the Government Code.

(d) The department shall make available to the public the standard the department will use to identify exemplary water demand management measures.

10645. (a) Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

(b) Not later than 30 days after filing a copy of its water shortage contingency plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

CHAPTER 4. Miscellaneous Provisions [10650 – 10657]

10650. Any actions or proceedings, other than actions by the board, to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:

(a) An action or proceeding alleging failure to adopt a plan or a water shortage contingency plan shall be commenced within 18 months after that adoption is required by this part.

(b) Any action or proceeding alleging that a plan or water shortage contingency plan, or action taken pursuant to either, does not comply with this part shall be commenced within 90 days after filing of the plan or water shortage contingency plan or an amendment to either pursuant to Section 10644 or the taking of that action.

10651. In any action or proceeding to attack, review, set aside, void, or annul a plan or a water shortage contingency plan, or an action taken pursuant to either by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.

10652. The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.

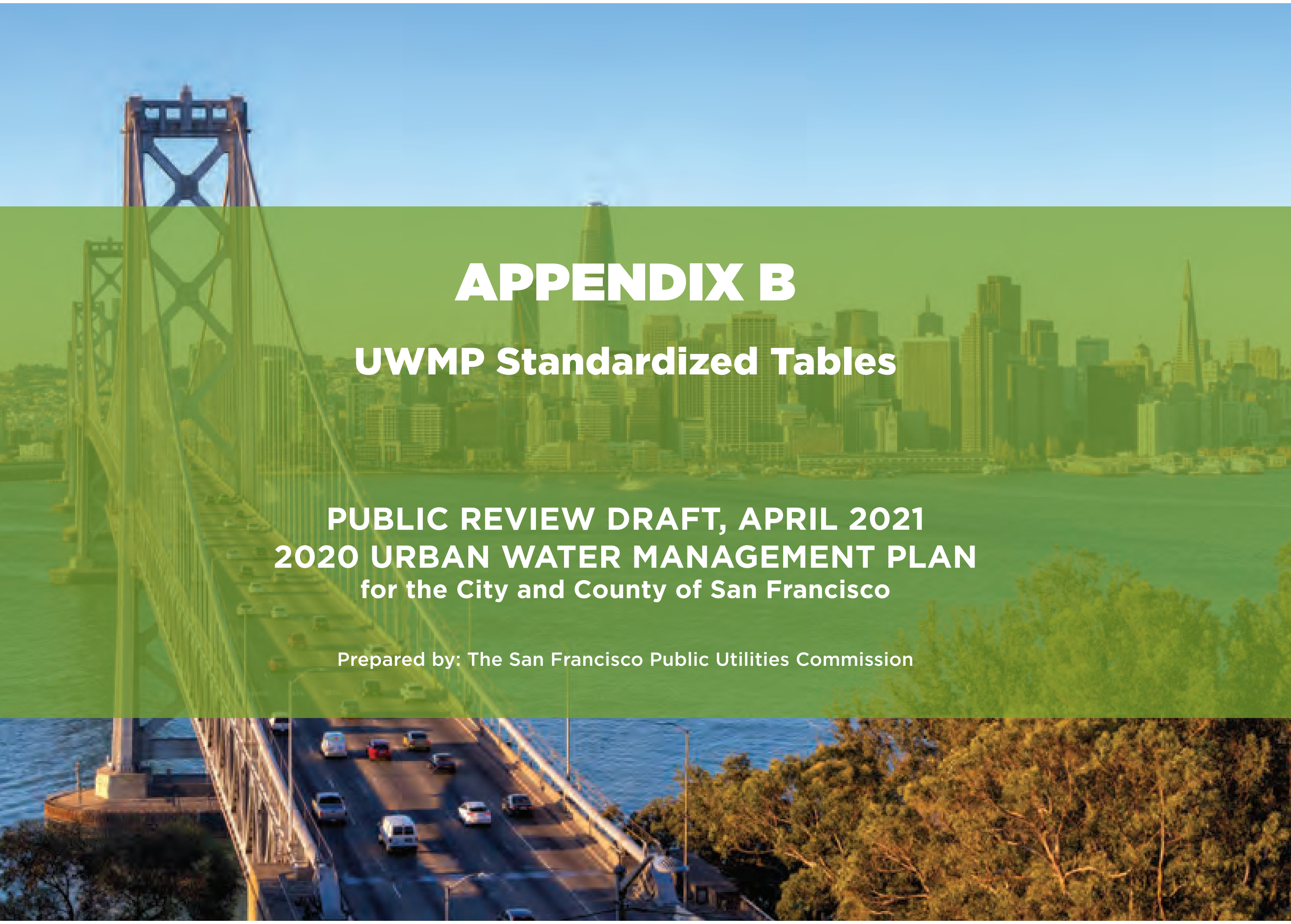
10653. The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the board and the Public Utilities Commission, for the preparation of water management plans, water shortage contingency plans, or conservation plans; provided, that if the board or the Public Utilities Commission requires additional information concerning water conservation, drought response measures, or financial conditions to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan that complies with analogous federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.

10654. An urban water supplier may recover in its rates the costs incurred in preparing its urban water management plan, its drought risk assessment, its water supply and demand assessment, and its water shortage contingency plan and implementing the reasonable water conservation measures included in either of the plans.

10655. If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.

10656. An urban water supplier is not eligible for a water grant or loan awarded or administered by the state unless the urban water supplier complies with this part.

10657. The department may adopt regulations regarding the definitions of water, water use, and reporting periods, and may adopt any other regulations deemed necessary or desirable to implement this part. In developing regulations pursuant to this section, the department shall solicit broad public participation from stakeholders and other interested persons.



APPENDIX B

UWMP Standardized Tables

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Submittal Table 2-1 Retail Only: Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2020	Volume of Water Supplied 2020 *
Add additional rows as needed			
CA3810011	SFPUC - CITY DISTRIBUTION DIVISION	173,774	73,150
CA0110018	SFPUC - PLEASANTON WELLS	1	340
CA0110012	SFPUC - TOWN OF SUNOL	141	60
	TOTAL	173,916	73,550
**** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*			
NOTES:			

Submittal Table 2-2: Plan Identification

Select Only One	**Type of Plan**		**Name of RUWMP or Regional Alliance** *if applicable* (select from drop down list)
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☐	Water Supplier is also a member of a Regional Alliance	
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

Submittal Table 2-3: Supplier Identification

Type of Supplier (select one or both)	
☑	Supplier is a wholesaler
☑	Supplier is a retailer
Fiscal or Calendar Year (select one)	
☐	UWMP Tables are in calendar years
☑	UWMP Tables are in fiscal years
If using fiscal years provide month and date that the fiscal year begins (mm/dd)	
7/1	
Units of measure used in UWMP * (select from drop down)	
Unit	AF
**** Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*	
NOTES: Values are rounded to the nearest 10 AF in the standardized tables. The units of measure used in the body of the UWMP are millions of gallons per day (mgd).	

Submittal Table 2-4 Retail: Water Supplier Information Exchange
The retail Supplier has informed the following wholesale supplier(s) of projected water use in accordance with Water Code Section 10631.
Wholesale Water Supplier Name
Add additional rows as needed
Not applicable. The SFPUC does not receive water from any wholesale supplier.
NOTES:

Submittal Table 2-4 Wholesale: Water Supplier Information Exchange (select one)	
☑	Supplier has informed more than 10 other water suppliers of water supplies available in accordance with Water Code Section 10631. Completion of the table below is optional. If not completed, include a list of the water suppliers that were informed.
	Provide page number for location of the list.
☐	Supplier has informed 10 or fewer other water suppliers of water supplies available in accordance with Water Code Section 10631. **Complete the table below.**

Water Supplier Name
Add additional rows as needed
City of Brisbane
City of Burlingame
City of Daly City
City of East Palo Alto
City of Hayward
City of Menlo Park
City of Millbrae
City of Milpitas
City of Mountain View
City of Palo Alto
City of Redwood City
City of San Bruno
City of San Jose
City of Santa Clara
City of Sunnyvale
Town of Hillsborough
Alameda County Water District
Coastside County Water District
Cordilleras Mutual Water Company
Estero Municipal Improvement District
Guadalupe Valley Municipal Improvement District
Mid-Peninsula Water District
North Coast County Water District
Purissima Hills Water District
Westborough Water District
California Water Service Company
Stanford University
Groveland Community Services District [1]
NOTES: 1. Groveland Community Services District (CSD) is contractually defined as a retail customer of the SFPUC and is accounted as such in SFPUC's previous planning documents. However, for the purpose of the 2020 UWMP update, SFPUC was directed by DWR to report Groveland CSD as a wholesale customer.

Submittal Table 3-1 Retail: Population - Current and Projected

Population Served	2020	2025	2030	2035	2040	2045*(opt)*
	899,732	1,004,799	1,066,403	1,128,007	1,189,610	1,251,214

NOTES: Population projections reflect the total population of in-City and suburban retail customers.
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 3-1W instead of this table.

Submittal Table 3-1 Wholesale: Population - Current and Projected

Population Served	2020	2025	2030	2035	2040	2045*(opt)*
	1,861,643	1,944,854	2,035,472	2,191,056	2,314,808	2,441,801

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included this table.

Submittal Table 4-1 Retail: Demands for Potable and Non-Potable Water - Actual

Use Type	2020 Actual		
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool	Additional Description (as needed)	Level of Treatment When Delivered Drop down list	Volume*
Add additional rows as needed			
Single Family		Drinking Water	16,350
Multi-Family		Drinking Water	25,650
Other	Non-residential: commercial, industrial and institutional	Drinking Water	26,880
Losses	Includes both apparent losses and real losses (See Appendix F for AWWA audit worksheet)	Drinking Water	8,070
		TOTAL	76,950

*** Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer in all the standardized tables. Their demand is included in Table 4-1W. However, the corresponding retail table in the UWMP includes Groveland CSD.

Submittal Table 4-1 Wholesale: Demands for Potable and Non-Potable Water - Actual

Use Type	2020 Actual		
Drop down list May select each use multiple times These are the only use types that will be recognized by the WUE data online submittal tool	Additional Description (as needed)	Level of Treatment When Delivered Drop down list	Volume*
Add additional rows as needed			
Sales to other agencies	Based on purchase requests	Drinking Water	148,310
		TOTAL	148,310

**** Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Submittal Table 4-2 Retail: Use for Potable and Non-Potable Water - Projected

Use Type	Additional Description (as needed)	Projected Water Use* *Report To the Extent that Records are Available*				
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool		2025	2030	2035	2040	2045 (opt)
Add additional rows as needed						
Single Family		15,460	15,240	15,120	15,240	15,230
Multi-Family		26,550	28,680	31,260	33,940	36,970
Other	All non-residential [1]	27,780	27,330	27,220	27,670	28,230
Losses		6,720	6,720	6,720	6,720	6,720
	TOTAL	76,510	77,970	80,320	83,570	87,150

**** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer. Their demand is included in Table 4-2W. However, the corresponding retail table in the UWMP includes Groveland CSD.
1. The "Other" category includes all non-residential water demands (commercial, industrial, irrigation, etc.). Water demands served by recycled water supplies fall under this category and were subtracted from the numbers reported in this table, in accordance with Table 6-4, which provides a separate line item for the "Recycled Water Demands".

Submittal Table 4-2 Wholesale: Use for Potable and Raw Water - Projected

Use Type	Additional Description (as needed)	Projected Water Use * Report To the Extent that Records are Available				
Drop down list May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool.		2025	2030	2035	2040	2045 (opt)
Add additional rows as needed						
Sales to other agencies	Projected purchase requests	163,940	166,000	170,490	175,420	182,640
TOTAL		163,940	166,000	170,490	175,420	182,640

*** Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer in this standardized table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Submittal Table 4-3 Retail: Total Water Use (Potable and Non-Potable)

	2020	2025	2030	2035	2040	2045 (opt)
Potable Water, Raw, Other Non-potable *From Tables 4-1R and 4-2 R*	76,950	76,510	77,970	80,320	83,560	87,150
Recycled Water Demand[1] *From Table 6-4*	110	2,350	2,800	2,800	2,800	2,800
Optional Deduction of Recycled Water Put Into Long-Term Storage[2]						
TOTAL WATER USE	77,060	78,860	80,770	83,120	86,360	89,950

[1] Recycled water demand fields will be blank until Table 6-4 is complete
*[2] Long term storage means water placed into groundwater or surface storage that is not removed from storage in the same year. Supplier **may** deduct recycled water placed in long-term storage from their reported demand. This value is manually entered into Table 4-3.*

NOTES:
Recycled water use for landscape irrigation in 2020 reflects the recycled water supplied by the Sharp Park Recycled Water Project for golf course irrigation. Future projections reflect recycled water supply served by the planned Westside Recycled Water Project, and the existing Sharp Park Recycled Water Project and the Harding Park Recycled Water Project.
Also note that per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer in all standardized tables. Their demand is included in Table 4-3W. However, the corresponding retail table in the UWMP includes Groveland CSD.

Submittal Table 4-3 Wholesale: Total Water Use (Potable and Non-Potable)

	2020	2025	2030	2035	2040	2045 (opt)
Potable and Raw Water From Tables 4-1W and 4-2W	148,310	163,940	166,000	170,490	175,420	182,640
Recycled Water Demand* From Table 6-4W	0	0	0	0	0	0
TOTAL WATER DEMAND	148,310	163,940	166,000	170,490	175,420	182,640

**Recycled water demand fields will be blank until Table 6-4 is complete.*

NOTES:
Wholesale demands are based on purchase requests projections.
Per DWR direction, Groveland CSD is accounted for as a wholesale customer in all the standardized tables and is therefore included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Submittal Table 4-4 Retail: Last Five Years of Water Loss Audit Reporting

Reporting Period Start Date (mm/yyyy)	Volume of Water Loss [1,2]
07/2015	6,750
07/2016	5,830
07/2017	6,750
07/2018	6,910
07/2019	8,070

[1] Taken from the field "Water Losses" (a combination of apparent losses and real losses) from the AWWA worksheet.

*[2] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 4-5 Retail Only: Inclusion in Water Use Projections	
Are Future Water Savings Included in Projections? (Refer to Appendix K of UWMP Guidebook) *Drop down list (y/n)*	Yes
If "Yes" to above, state the section or page number, in the cell to the right, where citations of the codes, ordinances, or otherwise are utilized in demand projections are found.	Appendix G
Are Lower Income Residential Demands Included In Projections? *Drop down list (y/n)*	Yes
NOTES:	

Submittal Table 5-1 Baselines and Targets Summary From SB X7-7 Verification Form

Retail Supplier or Regional Alliance Only

Baseline Period	Start Year *	End Year *	Average Baseline GPCD*	Confirmed 2020 Target*
10-15 year	*2001*	*2010*	*107*	*96*
5 Year	*2006*	*2010*	*101*	

**All cells in this table should be populated manually from the supplier's SBX7-7 Verification Form and reported in Gallons per Capita per Day (GPCD)*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

Submittal Table 5-2: 2020 Compliance From SB X7-7 2020 Compliance Form
Retail Supplier or Regional Alliance Only

2020 GPCD			2020 Confirmed Target GPCD*	Did Supplier Achieve Targeted Reduction for 2020? Y/N
Actual 2020 GPCD*	2020 TOTAL Adjustments*	Adjusted 2020 GPCD* *(Adjusted if applicable)*		
76	-	-	*96*	*Y*

**All cells in this table should be populated manually from the supplier's SBX7-7 2020 Compliance Form and reported in Gallons per Capita per Day (GPCD)*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

Submittal Table 6-1 Retail: Groundwater Volume Pumped						
☐	Supplier does not pump groundwater. The supplier will not complete the table below.					
☐	All or part of the groundwater described below is desalinated.					
Groundwater Type ***Drop Down List*** *May use each category multiple times*	Location or Basin Name	2016*	2017*	2018*	2019*	2020*
Add additional rows as needed						
Alluvial Basin	Westside Basin (1)	1340	1460	1900	1904	2240
Alluvial Basin	Livermore Valley Basin, Central Groundwater Sub Basin (2)	450	450	340	450	340
	TOTAL	1,790	1,910	2,240	2,354	2,580
**** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*						

NOTES:
(1) Data from 2016-2019 are obtained from the 2019 Annual Groundwater Monitoring Report, Westside Basin (SFPUC, April 2020), 2020 data are from verbal communications with SFPUC groundwater staff. Pumping volumes are reported on a calendar year basis, but are used to approximate fiscal year data for this table.
(2) The Livermore Valley Basin and Central Groundwater Sub Basin are the source of water for the Castlewood Well System. Pumping volumes are assumed to be equivalent to billed consumption for Castlewood CSA.

Submittal Table 6-1 Wholesale: Groundwater Volume Pumped						
☑	Supplier does not pump groundwater. The supplier will not complete the table below.					
☐	All or part of the groundwater described below is desalinated.					
Groundwater Type ***Drop Down List*** *May use each category multiple times*	Location or Basin Name	2016*	2017*	2018*	2019*	2020*
Add additional rows as needed						
	TOTAL	0	0	0	0	0
**** Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES:						

Submittal Table 6-2 Retail: Wastewater Collected Within Service Area in 2020

☐	There is no wastewater collection system. The supplier will not complete the table below.
100%	Percentage of 2015 service area covered by wastewater collection system *(optional)*
100%	Percentage of 2015 service area population covered by wastewater collection system *(optional)*

Wastewater Collection			**Recipient of Collected Wastewater**			
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated? *Drop Down List*	Volume of Wastewater Collected from UWMP Service Area 2020 *	Name of Wastewater Treatment Agency Receiving Collected Wastewater	Treatment Plant Name	Is WWTP Located Within UWMP Area? *Drop Down List*	Is WWTP Operation Contracted to a Third Party? *(optional)* *Drop Down List*
SFPUC	Metered	63,350 [1]	SFPUC	Southeast Water Pollution Control Plant	Yes	No
SFPUC	Metered	16,410 [1]	SFPUC	Oceanside Water Pollution Control Plant	Yes	No
US Navy	Metered	370	US Navy and Treasure Island Development Authority	Treasure Island Wastewater Treatment Plant	Yes	Yes
City and County of San Francisco	Metered	430 [2]	City and County of San Francisco	Mel Leong Treatment Plant	Yes	No
Total Wastewater Collected from Service Area in 2020:		80,560				

**** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
1. At the Southeast and Oceanside WPCPs, metered effluent flows include both primary-only and secondary treated effluent (the bulk of which is secondary treated) and flows include treated combined wastewater and stormwater because the collection systems are predominantly combined systems.
2. Volume of wastewater collected at the Mel Leong Treatment Plant corresponds to calendar year 2020.

Submittal Table 6-3 Retail: Wastewater Treatment and Discharge Within Service Area in 2020

☐ **No wastewater is treated or disposed of within the UWMP service area.** The supplier will not complete the table below.

Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)* 2	Method of Disposal **Drop down list**	Does This Plant Treat Wastewater Generated Outside the Service Area? **Drop down list**	Treatment Level **Drop down list**	2020 volumes [1]				
							Waste water Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
Southeast Water Pollution Control Plant and North Point Wet Weather Facility [1,2]	Discharge Point No. 001; Discharge Point No. 002; Discharge Point Nos. 003-006	Lower San Francisco Bay; Islais Creek; Central San Francisco Bay	2 386010001	Bay or estuary outfall	Yes	Secondary, Undisinfected*	62,920	58,310 [4]	0	0	0
Oceanside Water Pollution Control Plant [1]	Discharge Point No. 001	Pacific Ocean, Offshore	2 386009001	Ocean outfall	Yes	Secondary, Undisinfected	16,300	16,790 [5]	0	0	0
Treasure Island Wastewater Treatment Plant [2]	Discharge Point No. 001	Central San Francisco Bay	2 386013001	Bay or estuary outfall	No	Secondary, Undisinfected*	370	330	0	0	0
Mel Leong Treatment Plant [2,3]	North Bayside System Unit	Lower San Francisco Bay	2 417033001	Bay or estuary outfall	No	Secondary, Undisinfected*	430	430	0	0	0
						Total	80,020	75,860	0	0	0

[1] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.
[2] If the **Wastewater Discharge ID Number** is not available to the UWMP preparer, access the SWRCB CIWQS regulated facility website at https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/CiwqsReportServlet?inCommand=reset&reportName=RegulatedFacility

NOTES: 1. At the Southeast and Oceanside WPCPs, metered effluent flows include both primary-only and secondary treated effluent (the bulk of which is secondary treated) and flows include treated combined wastewater and stormwater because the collection systems are predominantly combined systems.
2. At the Southeast Water Pollution Control Plant, Treasure Island Wastewater Treatment Plant, and Mel Leong Treatment Plant, wastewater are secondary treated and disinfected (that option was not available in the spreadsheet template's original dropdown menu.)
3. Volume of wastewater collected at the Mel Leong Treatment Plant corresponds to calendar year 2020.
4. The volume discharged is less than the volume collected because a small volume of the discharged wastewater is treated to secondary, disinfected-23 level and used for other purposes.
5. The volume discharged is higher than the volume collected because the discharged volume includes additional plant recycle streams.

Submittal Table 6-3 Wholesale: Wastewater Treatment and Discharge Within Service Area in 2020

☑ Wholesale Supplier neither distributes nor provides supplemental treatment to recycled water. The Supplier will not complete the table below.

Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)* [2]	Method of Disposal ***Drop down list***	Does This Plant Treat Wastewater Generated Outside the Service Area? ***Drop down list***	Treatment Level ***Drop down list***	**2020 volumes** [1]				
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
Add additional rows as needed											
						Total	0	0	0	0	0

[1] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.

[2] If the **Wastewater Discharge ID Number** is not available to the UWMP preparer, access the SWRCB CIWQS regulated facility website at https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/CiwqsReportServlet?inCommand=reset&reportName=RegulatedFacility

NOTES:

Submittal Table 6-4a Retail: Recycled Water Direct Beneficial Uses Within Service Area

☐ Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.

Name of Supplier Producing (Treating) the Recycled Water:	SFPUC
Name of Supplier Operating the Recycled Water Distribution System:	SFPUC
Supplemental Water Added in 2020 (volume) *Include units*	0
Source of 2020 Supplemental Water	Not applicable

Beneficial Use Type *Insert additional rows if needed.*	**Potential** Beneficial Uses of Recycled Water (Describe)	Amount of **Potential** Uses of Recycled Water (Quantity) *Include volume units*[1]	General Description of 2020 Uses	Level of Treatment *Drop down list*	2020 [1]	2025 [1]	2030[1]	2035[1]	2040[1]	2045[1] (opt)
Landscape irrigation (exc golf courses)	Irrigation for Golden Gate Park and SF Zoo		No uses in 2020	Advanced	0	1,680	1,680	1,680	1,680	1,680
Landscape irrigation (exc golf courses)	Irrigation for Treasure Island		No uses in 2020	Tertiary	0	220	220	220	220	220
Golf course irrigation	Irrigation for Lincoln Park and Presidio golf courses		No uses in 2020	Advanced	0	120	340	340	340	340
Other (Description Required)	Direct non-potable reuse to serve dual plumbed buildings on Treasure Island		No uses in 2020	Tertiary	0	0	230	230	230	230
				Total:	0	2,020	2,470	2,470	2,470	2,470
				2020 Internal Reuse						

[1] ***Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: The landscape and irrigation recycled water uses included in this table will be supplied by the Westside Recycled Water Project and the Treasure Island Recycled Water Project.

Submittal Table 6-4b Retail: Recycled Water Direct Beneficial Uses Within Service Area

☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.
Name of Supplier Producing (Treating) the Recycled Water:	North San Mateo County Sanitation District (NSMCSD)
Name of Supplier Operating the Recycled Water Distribution System:	NSMCSD (portion of transmission line within the City and County of San Francisco is operated by SFPUC)
Supplemental Water Added in 2020 (volume) *Include units*	0
Source of 2020 Supplemental Water	Not applicable

Beneficial Use Type *Insert additional rows if needed.*	**Potential** Beneficial Uses of Recycled Water (Describe)	Amount of **Potential** Uses of Recycled Water (Quantity) *Include volume units*[1]	General Description of 2020 Uses	Level of Treatment *Drop down list*	2020[1]	2025[1]	2030[1]	2035[1]	2040[1]	2045[1] (opt)
Golf course irrigation	Harding Park and Fleming Golf Courses irrigation		No uses in 2020	Tertiary	0	220	220	220	220	220
				Total:	0	220	220	220	220	220
				2020 Internal Reuse						

[1] ***Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 6-4c Retail: Recycled Water Direct Beneficial Uses Within Service Area

☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.									
Name of Supplier Producing (Treating) the Recycled Water:				North Coast County Water District						
Name of Supplier Operating the Recycled Water Distribution System:				North Coast County Water District						
Supplemental Water Added in 2020 (volume) *Include units*				0						
Source of 2020 Supplemental Water				Not applicable						
Beneficial Use Type *Insert additional rows if needed.*	**Potential** Beneficial Uses of Recycled Water (Describe)	Amount of **Potential** Uses of Recycled Water (Quantity) *Include volume units*[1]	General Description of 2020 Uses	Level of Treatment *Drop down list*	2020[1]	2025[1]	2030[1]	2035[1]	2040[1]	2045[1] (opt)
Golf course irrigation	irrigation of Sharp Park Golf Course		irrigation of Sharp Park Golf Course	Tertiary	110	110	110	110	110	110
				Total:	110	110	110	110	110	110
				2020 Internal Reuse						

[1] ***Units of measure (AF, CCF, MG)*** *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 6-4 Wholesale: Current and Projected Retailers Provided Recycled Water Within Service Area							
☑	Recycled water is not directly treated or distributed by the Supplier. The Supplier will not complete the table below.						
Name of Receiving Supplier or Direct Use by Wholesaler	Level of Treatment *Drop down list*	2020*	2025*	2030*	2035*	2040*	2045* *(opt)*
Add additional rows as needed							
	Total	0	0	0	0	0	0
*** Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.							
NOTES:							

Submittal Table 6-5 Retail: 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual

☐ Recycled water was not used in 2015 nor projected for use in 2020.
The supplier will not complete the table below. If recycled water was not used in 2020, and was not predicted to be in 2015, then check the box and do not complete the table.

Beneficial Use Type	2015 Projection for 2020 [1]	2020 Actual Use[1]
Insert additional rows as needed.		
Agricultural irrigation		
Landscape irrigation (exc golf courses)		
Golf course irrigation	340	120
Commercial use		
Industrial use		
Geothermal and other energy production		
Seawater intrusion barrier		
Recreational impoundment		
Wetlands or wildlife habitat		
Groundwater recharge (IPR)		
Reservoir water augmentation (IPR)		
Direct potable reuse		
Other (Description Required)		
Total	340	120

[1] **Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.

NOTE:
Golf course irrigation includes Harding Park, Fleming and Sharp Park golf courses. The disparity between the predicted 2020 recycled water use and the actual 2020 recycled water used is approximately 220 acre-feet because the Harding Park Recycled Water Project was offline in 2020 due to necessary infrastructure upgrades.

Submittal Table 6-5 Wholesale: 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual		
☑	Recycled water was not used or distributed by the supplier in 2015, nor projected for use or distribution in 2020. The wholesale supplier will not complete the table below.	
Name of Receiving Supplier or Direct Use by Wholesaler	2015 Projection for 2020*	2020 Actual Use*
Add additional rows as needed		
Total	0	0
****Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*		
NOTES:		

Submittal Table 6-6 Retail: Methods to Expand Future Recycled Water Use			
☐	Supplier does not plan to expand recycled water use in the future. Supplier will not complete the table below but will provide narrative explanation.		
Section 6.2.2	Provide page location of narrative in UWMP		
Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use *
Add additional rows as needed			
Westside Recycled Water Project	Construction of a Recycled Water Treatment Plant at the Oceanside Water Pollution Control Plant to serve recycled water for landscape irrigation at Golden Gate Park, Lincoln Park Golf Course, Presidio Golf Course, and other irrigated areas in the Presidio.	2025	2,020
Treasure Island Water Resource Recovery Facility	Construction of a wastewater treatment facility that will provide Title 22 disinfected tertiary-level treated effluent that will serve dual-plumbed buildings, and supply water for outdoor urban agriculture and irrigation.	2022	450
Ordinances, Programs, and Services	The SFPUC administers or helps to administer various ordinances, programs, and services in the City related to recycled water and water reuse. The majority of these ordinances, programs, and services have been established for many years and are ongoing, resulting in increased water reuse. These include Soil Compaction and Dust Control Ordinance, Recycled Water Ordinance, Large Landscape Grant Program and Onsite Potable Reuse Program.	2022	0
		Total	2,470
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*			
NOTES: See UWMP Section 6.2.2 for more information.			

Submittal Table 6-7 Retail: Expected Future Water Supply Projects or Programs						
☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.					
☑	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.					
Sections 6.2.2 & 7.4	Provide page location of narrative in the UWMP					
Name of Future Projects or Programs	Joint Project with other suppliers?		Description (if needed)	Planned Implementation Year	Planned for Use in Year Type *Drop Down List*	Expected Increase in Water Supply to Supplier* *This may be a range*
	Drop Down List (y/n)	*If Yes, Supplier Name*				
Add additional rows as needed						
Westside Recycled Water Project	No			2025	All Year Types	2,020
Treasure Island Recycled Water Project	No			2022	All Year Types	450 - 1120
San Francisco Groundwater Supply Project [1]	No			Existing & Progressive Expansion	All Year Types	Up to 4480
***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*						
NOTES: 1. Part of the San Francisco Groundwater Supply Project has been implemented, and currently produces approximately 450 acre-feet of potable water. A progressive expansion is planned, adding 1120 acre-feet of supply at a time, with a total anticipated capacity of 4480 acre-feet.						

Submittal Table 6-7 Wholesale: Expected Future Water Supply Projects or Programs

☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.
☑	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.
Section 7.4	Provide page location of narrative in the UWMP

Name of Future Projects or Programs	Joint Project with other suppliers?		Description *(if needed)*	Planned Implementation Year	Planned for Use in Year Type *Drop Down list*	Expected Increase in Water Supply to Supplier*
	Drop Down Menu	*If Yes, Supplier Name*				
Add additional rows as needed						

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 6-8 Retail: Water Supplies — Actual

Water Supply		2020		
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool	Additional Detail on Water Supply	Actual Volume*	Water Quality Drop Down List	Total Right or Safe Yield* (optional)
Add additional rows as needed				
Surface water (not desalinated)		74,490	Drinking Water	
Groundwater (not desalinated)		450	Drinking Water	
Groundwater (not desalinated)		1,680	Other Non-Potable Water	
Purchased or Imported Water	Sharp Park	110	Recycled Water	
Purchased or Imported Water	Harding Park	0	Recycled Water	
	Total	76,730		0

Units of measure (AF, CCF, MG) *must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 6-8 Wholesale instead of this table. However, the corresponding retail table in the UWMP includes Groveland CSD.

Submittal Table 6-8 Wholesale: Water Supplies — Actual				
Water Supply	Additional Detail on Water Supply	2020		
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Actual Volume*	Water Quality Drop Down List	Total Right or Safe Yield* (optional)
Add additional rows as needed				
Surface water (not desalinated)		148,310	Drinking Water	
	Total	148,310		0
***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*				
NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.				

Submittal Table 6-9 Retail: Water Supplies — Projected

Water Supply		**Projected Water Supply *** Report To the Extent Practicable									
		2025		**2030**		**2035**		**2040**		**2045** (opt)	
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool	Additional Detail on Water Supply	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)
Add additional rows as needed											
Surface water (not desalinated)		74,940		75,280		76,510		78,640		82,220	
Groundwater (not desalinated)		1,570		2,690		3,810		4,930		4,930	
Recycled Water	See Table 6-4R for recycled water supplies	2,350		2,800		2,800		2,800		2,800	
	Total	78,860	0	80,770	0	83,120	0	86,370	0	89,950	0

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is reported as a wholesale customer in all standardized tables.

Submittal Table 6-9 Wholesale: Water Supplies — Projected											
Water Supply	Additional Detail on Water Supply	**Projected Water Supply*** Report To the Extent Practicable									
		2025		**2030**		**2035**		**2040**		**2045** (opt)	
Drop down list May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool		Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)	Reasonably Available Volume	Total Right or Safe Yield (optional)
Add additional rows as needed											
Surface water (not desalinated)		163,940		166,000		170,490		175,420		182,640	
	Total	163,940	0	166,000	0	170,490	0	175,420	0	182,640	0
***Units of measure (AF, CCF, MG)** *must remain consistent throughout the UWMP as reported in Table 2-3.*											
NOTES:											

Submittal Table 7-1 Retail: Basis of Water Year Data (Reliability Assessment)

<table>
<tr><th rowspan="4">Year Type</th><th rowspan="4">Base Year
If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 2019-2020, use 2020</th><th colspan="3">Available Supplies if Year Type Repeats</th></tr>
<tr><td>☑</td><td colspan="2">Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP.
Location: Table 8-2 & Table 8-3</td></tr>
<tr><td>☐</td><td colspan="2">Quantification of available supplies is provided in this table as either volume only, percent only, or both.</td></tr>
<tr><th colspan="2">Volume Available *</th><th>% of Average Supply</th></tr>
<tr><td>Average Year</td><td></td><td colspan="2"></td><td>100%</td></tr>
<tr><td>Single-Dry Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Consecutive Dry Years 1st Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Consecutive Dry Years 2nd Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Consecutive Dry Years 3rd Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Consecutive Dry Years 4th Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Consecutive Dry Years 5th Year</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5"><i>Supplier may use multiple versions of Table 7-1 if different water sources have different base years and the supplier chooses to report the base years for each water source separately. If a Supplier uses multiple versions of Table 7-1, in the "Note" section of each table, state that multiple versions of Table 7-1 are being used and identify the particular water source that is being reported in each table.</i></td></tr>
<tr><td colspan="5"><i>*Units of measure (AF, CCF, MG) must remain consistent throughout the UWMP as reported in Table 2-3.</i></td></tr>
<tr><td colspan="5">NOTES:</td></tr>
</table>

Submittal Table 7-1 Wholesale: Basis of Water Year Data (Reliability Assessment)

Year Type	**Base Year** If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 1999-2000, use 2000	**Available Supplies if Year Type Repeats**	
		☑	Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location: Table 8-3
		☐	Quantification of available supplies is provided in this table as either volume only, percent only, or both.
		Volume Available *	**% of Average Supply**
Average Year			100%
Single-Dry Year			
Consecutive Dry Years 1st Year			
Consecutive Dry Years 2nd Year			
Consecutive Dry Years 3rd Year			
Consecutive Dry Years 4th Year			
Consecutive Dry Years 5th Year			

Supplier may use multiple versions of Table 7-1 if different water sources have different base years and the supplier chooses to report the base years for each water source separately. If a supplier uses multiple versions of Table 7-1, in the "Note" section of each table, state that multiple versions of Table 7-1 are being used and identify the particular water source that is being reported in each table. Suppliers may create an additional worksheet for the additional tables.

****Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES:

Submittal Table 7-2 Retail: Normal Year Supply and Demand Comparison

	2025	2030	2035	2040	2045 *(Opt)*
Supply totals (*autofill from Table 6-9)*	78,860	80,770	83,120	86,370	89,950
Demand totals *(autofill from Table 4-3)*	78,860	80,770	83,120	86,370	89,950
Difference	0	0	0	0	0

NOTES: Per DWR direction, Groveland CSD is reported as a wholesale customer in the standardized tables. Their supplies and demands are included in Table 7-2W.

Submittal Table 7-2 Wholesale: Normal Year Supply and Demand Comparison

	2025	2030	2035	2040	2045 *(Opt)*
Supply totals *(autofill from Table 6-9)*	163,940	166,000	170,490	175,420	182,640
Demand totals *(autofill fm Table 4-3)*	163,940	166,000	170,490	175,420	182,640
Difference	0	0	0	0	0

NOTES: Per DWR direction, Groveland CSD is reported as a wholesale customer in the standardized tables. Their supplies and demands are included in this table.

Submittal Table 7-3 Retail: Single Dry Year Supply and Demand Comparison

	2025	2030	2035	2040	2045 (Opt)
Supply totals*	66,650	68,780	71,470	74,380	67,320
Demand totals*	79,200	81100	83,450	86,700	90,290
Difference	(12,550)	(12,320)	(11,980)	(12,320)	(22,970)

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore included in Table 7-3W.
These tables assume implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) starting in 2023. The implementation of the Bay-Delta Plan Amendment is uncertain for multiple reasons, including ongoing litigation. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect.

Submittal Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison					
	2025	2030	2035	2040 (Opt)	2045
Supply totals*	104,510	105,520	108,100	111,120	99,360
Demand totals*	163,550	165,680	170,160	175,080	182,370
Difference	(59,040)	(60,160)	(62,060)	(63,960)	(83,010)

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Groveland CSD is accounted for as a wholesale customer and is included in this table.
These tables assume implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) starting in 2023. The implementation of the Bay-Delta Plan Amendment is uncertain for multiple reasons, including ongoing litigation. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect.

Submittal Table 7-4 Retail: Multiple Dry Years Supply and Demand Comparison

		2025*	2030*	2035*	2040*	2045* (Opt)
First year	Supply totals	66,650	68,780	71,470	74,380	67,320
	Demand totals	79,200	81,100	83,450	86,700	90,290
	Difference	(12,550)	(12,320)	(11,980)	(12,320)	(22,970)
Second year	Supply totals	57,690	59,820	62,170	64,860	67,320
	Demand totals	79,200	81,100	83,450	86,700	90,290
	Difference	(21,510)	(21,280)	(21,280)	(21,840)	(22,970)
Third year	Supply totals	57,690	59,820	62,170	64,860	67,320
	Demand totals	79,200	81,100	83,450	86,700	90,290
	Difference	(21,510)	(21,280)	(21,280)	(21,840)	(22,970)
Fourth year	Supply totals	57,690	59,820	62,170	58,250	58,360
	Demand totals	79,200	81,100	83,450	86,700	90,290
	Difference	(21,510)	(21,280)	(21,280)	(28,450)	(31,930)
Fifth year	Supply totals	57,690	59,820	57,580	58,250	58,360
	Demand totals	79,200	81,100	83,450	86,700	90,290
	Difference	(21,510)	(21,280)	(25,870)	(28,450)	(31,930)
Sixth year *(optional)*	Supply totals					
	Demand totals					
	Difference	0	0	0	0	0

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 7-4 Wholesale instead of this table. However, the corresponding retail table in the UWMP includes Groveland CSD.
These tables assume implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) starting in 2023. The implementation of the Bay-Delta Plan Amendment is uncertain for multiple reasons, including ongoing litigation. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect.

Submittal Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2025*	2030*	2035*	2040*	2045* (Opt)
First year	Supply totals	104,510	105,520	108,100	111,120	99,360
	Demand totals	163,550	165,680	170,160	175,080	182,370
	Difference	(59,040)	(60,160)	(62,060)	(63,960)	(83,010)
Second year	Supply totals	104,180	90,510	92,640	95,330	99,360
	Demand totals	163,550	165,680	170,160	175,080	182,370
	Difference	(59,370)	(75,170)	(77,520)	(79,750)	(83,010)
Third year	Supply totals	89,610	90,510	92,640	95,330	99,360
	Demand totals	163,550	165,680	170,160	175,080	182,370
	Difference	(73,940)	(75,170)	(77,520)	(79,750)	(83,010)
Fourth year	Supply totals	89,610	90,510	92,640	84,130	84,460
	Demand totals	163,550	165,680	170,160	175,080	182,370
	Difference	(73,940)	(75,170)	(77,520)	(90,950)	(97,910)
Fifth year	Supply totals	89,610	90,510	84,910	84,130	84,460
	Demand totals	163,550	165,680	170,160	175,080	182,370
	Difference	(73,940)	(75,170)	(85,250)	(90,950)	(97,910)
Sixth year *(optional)*	Supply totals					
	Demand totals					
	Difference	0	0	0	0	0

Units of measure (AF, CCF, MG) m*ust remain consistent throughout the UWMP as reported in Table 2-3.*

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.
These tables assume implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) starting in 2023. The implementation of the Bay-Delta Plan Amendment is uncertain for multiple reasons, including ongoing litigation. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect.

Submittal Table 7-5: Five-Year Drought Risk Assessment Tables to address Water Code Section 10635(b)

2021	**Total**
Total Water Use	77,520
Total Supplies	73,710
Surplus/Shortfall w/o WSCP Action	(3,810)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	
Revised Surplus/(shortfall)	-3,810
Resulting % Use Reduction from WSCP action	0%
2022	**Total**
Total Water Use	77,960
Total Supplies	74,160
Surplus/Shortfall w/o WSCP Action	(3,800)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	
Revised Surplus/(shortfall)	-3,800
Resulting % Use Reduction from WSCP action	0%
2023	**Total**
Total Water Use	78,300
Total Supplies	52,980
Surplus/Shortfall w/o WSCP Action	(25,320)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	25,320
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	32%
2024	**Total**
Total Water Use	78,750
Total Supplies	52,980
Surplus/Shortfall w/o WSCP Action	(25,770)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	25,760
Revised Surplus/(shortfall)	-10
Resulting % Use Reduction from WSCP action	33%

2025	Total
Total Water Use	79,200
Total Supplies	53,990
Surplus/Shortfall w/o WSCP Action	(25,210)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	25,200
Revised Surplus/(shortfall)	-10
Resulting % Use Reduction from WSCP action	32%
NOTE: These tables assume implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) starting in 2023. The implementation of the Bay-Delta Plan Amendment is uncertain for multiple reasons, including ongoing litigation. The SFPUC recognizes that the Bay-Delta Plan Amendment has been adopted and that, given that it is now state law, we must plan for a future in which it is fully implemented. The SFPUC also acknowledges that the plan is not self-implementing and therefore does not automatically go into effect. The SFPUC is currently pursuing a voluntary agreement as well as a lawsuit which would limit implementation of the Plan. With both of these processes occurring on an unknown timeline, the SFPUC does not know at this time when the Bay-Delta Plan Amendment is likely to go into effect.	

Submittal Table 8-1
Water Shortage Contingency Plan Levels

Shortage Level	Percent Shortage Range	Shortage Response Actions *(Narrative description)*
1	Up to 10%	Voluntary retail water use reduction of 5%
2	Up to 20%	Voluntary retail water use reduction of 5%
3	Up to 30%	Voluntary retail water use reduction of 5%
4	Up to 40%	Voluntary or mandatory rationing for retail water use reduction of 5% to 18%
5	Up to 50%	Mandatory rationing for retail water use reduction of 18% to 32%
6	>50%	Mandatory rationing for retail water use reduction of >32%

NOTES:

Submittal Table 8-2: Demand Reduction Actions

Shortage Level	Demand Reduction Actions ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? ***For Retail Suppliers Only*** *Drop Down List*
Add additional rows as needed				
1, 2, and 3	Other	3.3 mgd	Voluntary call for water use reductions	No
4	Other	6.3 mgd	Mandatory rationing	Yes
5	Other	16.2 mgd	Mandatory rationing	Yes
6	Other	21.2 mgd	Mandatory rationing	Yes

NOTES:
a. Associated volume of reduction is based on 2025 projected unconstrained SFPUC Retail customer demands on the Regional Water System of 65.9 mgd. Volumes shown for each level represent the total shortage that must be met with the associated response action at that shortage level.
b. For Shortage Levels 1-3, the SFPUC expects to have enough supply to meet projected unconstrained retail demands. However, SFPUC has a contractual obligation that for any level of required reduction in system-wide water use during shortages, the SFPUC shall require Retail Customers to conserve a minimum of 5 percent. A 5 percent reduction in retail demand can be achieved with a voluntary call for reductions in water use.
c. The Level 6 shortage (assumed to be 55% system-wide supply reduction) has an associated 21.2 mgd shortage gap in 2025. The demand reductions are assumed to ultimately be met with a rationing approach consisting of a 25 gpcd floor for residential accounts, a 50% demand reduction in irrigation accounts, and 30% demand reduction in other non-residential accounts.

Submittal Table 8-3: Supply Augmentation and Other Actions			
Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool*	How much is this going to reduce the shortage gap? *Include units used (volume type or percentage)*	Additional Explanation or Reference *(optional)*
Add additional rows as needed			
NOTES:			

Submittal Table 10-1 Retail: Notification to Cities and Counties

City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
San Francisco	Yes	Yes
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
Alameda County	Yes	Yes
San Mateo County	Yes	Yes
Santa Clara County	Yes	Yes
San Joaquin County	Yes	Yes
Tuolumne County	Yes	Yes
NOTES: In addition to the cities and counties listed above, the SFPUC also notified various private organizations and communities that may be interested in participating in the UWMP process. A complete list of these entities can be found in Appendix C.		

Submittal Table 10-1 Wholesale: Notification to Cities and Counties (select one)		
☑	Supplier has notified more than 10 cities or counties in accordance with Water Code Sections 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**	
Appendix C	Provide the page or location of this list in the UWMP.	
☐	Supplier has notified 10 or fewer cities or counties. **Complete the table below.**	
City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
NOTES:		

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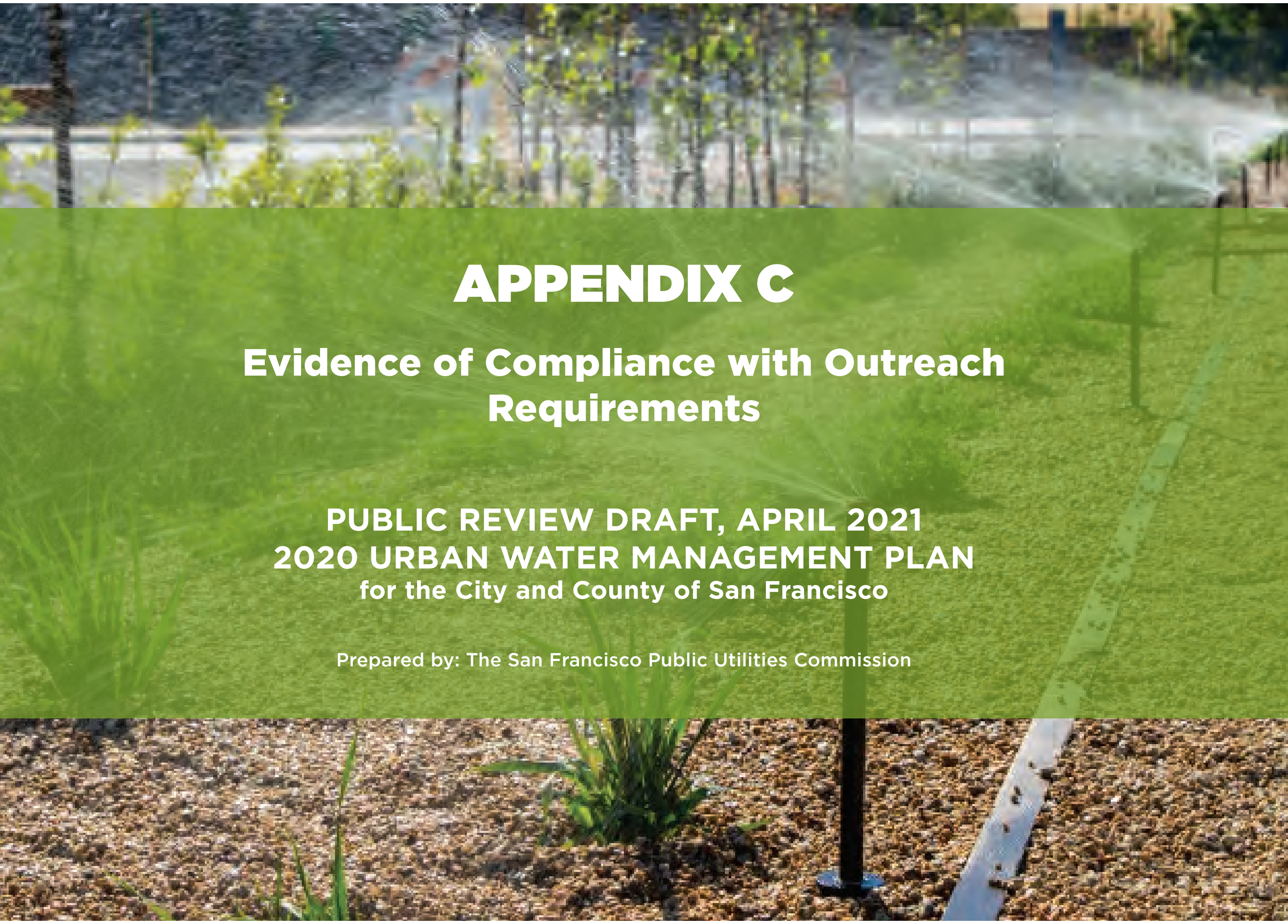


APPENDIX C

Evidence of Compliance with Outreach Requirements

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Summary Table of SFPUC Compliance with Public Notification Elements of the Urban Water Management Plan Act

Code Section	Code Requirement	Summary of Action Taken	Documentation (Attached after this Table)
Water Code Section 10620	Notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes.	✓ January 29, February 8 and March 12, 2021: Sent notification letters via email to City agencies, wholesale customers of the SFPUC Regional Water System, suburban retail customers (e.g., SFO), large regional water agencies (e.g., EBMUD), Bay Area Water Supply Conservation Agency (BAWSCA), and a larger distribution list of parties known by the SFPUC to be interested in water resources planning issues. ✓ April 5, 2021: Sent emails to all parties listed above regarding the availability of the Draft 2020 UWMP.	• Example of 2/08/21 letter sent via email (same letter sent via email on 03/08/21 to additional recipients) • Example of 4/05/21 email • Recipient list
Water Code Section 10642	Encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	✓ February 8 and March 12, 2021: Sent emails to a larger distribution list of parties known by the SFPUC to be interested in water resources planning issues. ✓ April 5, 2021: Will post the Draft 2020 UWMP on the SFPUC website at www.sfpuc.org ✓ March 29 and April 5, 2021: Posted advertisement in local community newspaper(s) regarding the availability of the Draft 2020 UWMP, as well as the time and location of the public hearing.	• Example of 2/08/21 letter sent via email (same letter sent via email on 03/12/21 to additional recipients) • Declaration of publication of San Francisco Chronicle and copy of advertisement
Water Code Section 10642	Prior to the required hearing, publish the notice of time and place of hearing within the jurisdiction of the supplier pursuant to Section 6066 of the Government Code.	✓ March 29 and April 5, 2021: Posted Notification of Public Hearing in local community newspaper meeting requirement of Section 6066 of the Government Code.	• Declaration of publication in San Francisco Chronicle and copy of advertisement
Water Code Section 10642	Prior to the required hearing, provide notice of time and place of hearing to any city of county within which the supplier provides water.	✓ February 8 and March 12, 2021: Provided notification of public hearing, including time and place of the hearing, in the same notification letter regarding the preparation of the 2020 UWMP Update.	• Example of 2/08/21 letter sent via email (same letter sent via email on 03/12/21 to additional recipients) • Recipient list (same as recipient list listed earlier)

Code Section	Code Requirement	Summary of Action Taken	Documentation (Attached after this Table)
Water Code Section 10642	Prior to adoption, make the plan available for public inspection.	✓ April 5, 2021: Will post the Draft 2020 UWMP on the SFPUC website at www.sfpuc.org	•
Water Code Section 10642	Prior to adoption, hold a public hearing.	✓ April 13, 2021: Will hold a public hearing during the meeting of the San Francisco Public Utilities Commission.	•
Water Code Section 10642	After the hearing, the plan shall be adopted as prepared or as modified after the meeting.	✓ June 7, 2021: Will adopt the SFPUC 2020 UWMP (as amended) during the meeting of the San Francisco Public Utilities Commission.	•
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to DWR.	✓ By July 1, 2021 (exact date to be determined): Will submit the adopted 2020 UWMP electronically via the WUEdata Online Submittal Tool.	•
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to the California State Library.	✓ By July 7, 2021 (exact date to be determined): Will mail an electronic copy of the adopted 2020 UWMP on compact disc to the California State Library.	•
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to any city or county within which the supplier provides water.	✓ By July 7, 2021 (exact date to be determined): Will email the adopted 2020 UWMP to all wholesale customers of the SFPUC Regional Water System, and cities or counties within which the SFPUC provides water.	•
Water Code Section 10645	Within 30 days of submittal to DWR, make the plan available for public review during normal business hours.	✓ By July 30, 2021 (exact date to be determined): Will provide two copies of the adopted 2020 UWMP to the San Francisco Main Library. ✓ By July 30, 2021 (exact date to be determined): Will post the adopted 2020 UWMP on the SFPUC website at www.sfpuc.org	•

Urban Water Management Plan

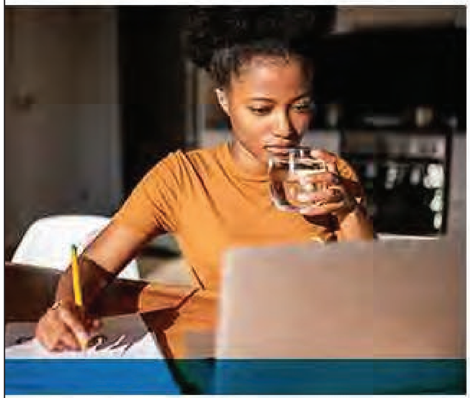
Dear Stakeholders,

The Urban Water Management Planning Act (Water Code Section 10610-10657) requires urban water supplier to **update its Urban Water Management Plan (UWMP)** and submit the completed plan to the California Department of Water Resources (DWR) every 5 years. The City and County of San Francisco is currently reviewing its UWMP and will be considering amendments or changes to the document. The 2020 update to the UWMP is due to DWR by July 1, 2021.

State law requires that urban water suppliers conduct a public hearing during the UWMP update process and that, at least 60 days prior to the public hearing, the City and County of San Francisco provide notice that it intends to update the UWMP to any city and county within which it provides water supplies. This letter serves as the required notification.

The UWMP will **provide an overview of our water deliveries and uses, water supply sources, and water conservation programs.** It will also include discussions on supply and demand projections over a 25-year planning horizon (from 2020 to 2045), available water supplies to meet existing and future demands under a range of water supply conditions, and our water demand management measures to reduce long-term water demand.

Proposed revisions to the UWMP will be available for public review and comment from April 5, 2021 to May 5, 2021. The Draft UWMP 2020 Update will be available on the SFPUC website and available for physical review and/or pick-up at a central location in downtown San Francisco. Additional information on how to access the UWMP will be provided in a later notification, prior to the start of the public review period.



Notice of Public Hearing

A public hearing will be held on April 13, 2021 at 1:30 pm at the meeting of the San Francisco Public Utilities Commission to allow interested members of the public to participate in the review process. All interested parties are invited to attend the public hearing and present their views. The hearing will be held virtually and can be accessed using the following information:

WATCH LIVE MEETING

Call-in number: 1 (415) 655-0001 / **MEETING ID:** 146 929 4145 # #

The final 2020 UWMP will be adopted by the Commission in June.

Submission of Comments

Any interested parties may also submit written comments to the City during the public comment period in one of three ways.

1. Written comments can be **e-mailed to Sarah Triolo,** striolo@sfwater.org.
2. Written comments can be **mailed to the address below.** To ensure that comments can be reviewed and incorporated, any mailed comments must be post-marked by **April 30th, 2021.**

   Steve Ritchie, San Francisco Public Utilities Commission
   525 Golden Gate Avenue, 13th Floor
   San Francisco, CA 94102

3. Written comments can be **deposited in the drop box** at 525 Golden Gate Avenue. Comments submitted via the drop box must be in an envelope with the following information clearly printed: "Urban Water Management Plan Comments, c/o Sarah Triolo".

In the meantime, if you have any questions about our UWMP, or the process of updating it, please contact Sarah Triolo at striolo@sfwater.org.

Sincerely,

Paula Kehoe

Director of Water Resources

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Recipients of 2020 UWMP Update Notification
(Sent via e-mail on January 29, 202, February 8, 2021 and March 12, 2021)

No.	Organization	Contact
1	California Water Service Company	Darin Duncan
2	California Water Service Company	Dawn Smithson
3	California Water Service Company	Tony Carrasco
4	City of Brisbane	Jerry Flanagan
5	City of Brisbane/Guadalupe Valley Municipal Improvement District	Randy Breault
6	City of Burlingame	Art Morimoto
7	City of Burlingame	George J. Bagdon
8	City of Daly City	Patrick Sweetland
9	City of East Palo Alto	Carlos Martinez
10	City of East Palo Alto	Maziar Bozorginia
11	City of Hayward	Alex Ameri
12	City of Hayward	Corinne Ferreyra
13	City of Menlo Park	Pam Lowe
14	City of Menlo Park	Ruben Nino
15	City of Millbrae	Khee Lim
16	City of Millbrae	Peter Vorametsanti
17	City of Millbrae	Shelley Reider
18	City of Milpitas	Nina Hawk
19	City of Milpitas	Steven Machida
20	City of Mountain View	Elizabeth Flegel
21	City of Mountain View	Gregg Hosfeldt
22	City of Palo Alto	Jane Ratchye
23	City of Palo Alto	Karla Dailey
24	City of Redwood City, Public Works Services Department	Justin Chapel
25	City of Redwood City, Public Works Services Department	Melissa Stevenson Diaz
26	City of Redwood City, Public Works Services Department	Terrence Kyaw
27	City of San Bruno	Jim Burch
28	City of San Bruno	Jimmy Tan
29	City of San Jose	Jeff Provenzano
30	City of San Jose	Mansour Nasser
31	City of Santa Clara	Chris DeGroot
32	City of Santa Clara	Robin Saunders
33	City of Sunnyvale	James Craig
34	City of Sunnyvale	John Stufflebean
35	City of Sunnyvale	Mansour Nasser
36	Coastside County Water District	David Dickson
37	Cordilleras Water District	Rick Thall
38	East Palo Alto Water District	Anthony Docto
39	Estero Municipal Improvement District	Jeff Moneda
40	Groveland Community Service	Jon Sterling

Recipients of 2020 UWMP Update Notification
(Sent via e-mail on January 29, 202, February 8, 2021 and March 12, 2021)

41	Mid-Peninsula Water District	Rene Ramirez
42	Mid-Peninsula Water District	Tammy Rudock
43	North Coast County Water District	Cari Lemke
44	Purissima Hills Water District	Patrick Walter
45	Stanford University	Julia Nussbaum
46	Town of Hillsborough	Paul Willis
47	Westborough Water District	Darryl Barrow
48	BAWSCA	Adrianne Carr
49	BAWSCA	Andree Johnson
50	BAWSCA	Christina Tang
51	BAWSCA	Michael Hurley
52	BAWSCA	Nicole Sandkulla
53	California State Assembly, AD12	Kristin Olsen
54	California State Coastal Conservancy	Matt Gerhart
55	California State Library Government Publications Section	Janet Coles
56	California State Seismic Safety Commission	Fred Turner
57	Department of Water Resources Office of Water Use Efficiency & Transfer	David Todd
58	U.S. EPA Region 9	David W. Smith
59	U.S. EPA Region 9	Dena Vallano
60	U.S. EPA Region 9	Nancy Woo
61	Contra Costa Water District	Jerry Brown
62	East Bay Municipal Utility District	Alexander Coate
63	East Bay Municipal Utility District	Priyanka Jain
64	Los Trancos County Water District	Stanley R. Gage
65	Marin Municipal Water District	Krishna Kumar
66	Santa Clara Valley Water District	Jim Fiedler
67	Santa Clara Valley Water District	Jerry De La Piedra
68	Zone 7 Water Agency	Jill Duerig
69	Zone 7 Water Agency	Amparo Flores
70	Turlock Irrigation District	Tou Her
71	County of San Mateo	Ed Garcia
72	Alameda County	Susan S. Muranishi
73	County of Santa Clara	Jeffrey V. Smith
74	San Joaquin County	Monica Nino
75	Tuolumne County	Craig Pedro
76	Castlewood Country Club	John Vest
77	Golden Gate National Cemetery	Bradley Phillips
78	Lawrence Livermore National Laboratory	Ellen Raber
79	Lawrence Livermore National Laboratory	Jackie Angell
80	Menlo Country Club	Christopher Robinson
81	National Park Service GGNRA	Allison Cryns

Recipients of 2020 UWMP Update Notification
(Sent via e-mail on January 29, 202, February 8, 2021 and March 12, 2021)

82	San Francisco State University	Barbara Holzman
83	San Francisco State University	Caitlin Steele
84	San Francisco State University	Charles A. Meyer
85	San Francisco State University	Davin Wentworth-Thrasher
86	San Francisco State University	Ryszard Dziadur
87	San Francisco Zoo	Tanya Peterson
88	The Villas Parkmerced	General e-mail address
89	American True / True Youth	Ward Latimer
90	Bay Area Water Stewards (BAWS)	Multiple members
91	Bayview Merchants Association	Al Norman
92	California Native Plant Society - Yerba Buena Chapter	Ellen Edelson
93	California Trout	Curtis Knight
94	Coalition for a Better Wastewater Solution	Jeff Marmer
95	Coalition For San Francisco Neighborhoods	Joan Girardot
96	Golden Gate Audubon Society	Cindy Margulis
97	Golden Gate Audubon Society	Dan Murphy
98	Golden Gate Heights Neighborhood Association	Frank Noto
99	Golden Gate Restaurant Association	Gwyneth Borden
100	Greater West Portal Neighborhood Association	Avum Shepard
101	Greater West Portal Neighborhood Association	General e-mail address
102	Greater West Portal Neighborhood Association	Rae Doyle
103	Lakeshore Acres Improvement Club	Jim Stark
104	North of the Panhandle Neighborhood Association	Tim Hickey
105	Oceanview, Merced Heights, Ingleside - Neighbors in Action (OMI-NIA)	Al Harris
106	Oceanview, Merced Heights, Ingleside - Neighbors in Action (OMI-NIA)	Mary Harris
107	Pacific Institute	Heather Cooley
108	Pacific Institute	Peter Gleick
109	Planning Association for the Richmond (PAR)	Ray Holland
110	Planning Association for the Richmond (PAR)	Richard Corriea
111	Plumbers Union Local 38	Larry Mazzola Jr.
112	Restore Hetch Hetchy	Spreck Rosekrans
113	San Francisco Beautiful	Darcy Brown
114	San Francisco Chamber of Commerce	Bob Linscheid
115	San Francisco Chamber of Commerce	Dee Dee Workman
116	San Francisco Chamber of Commerce	Jim Lazarus
117	San Francisco Council of District Merchants	Stephen Cornell
118	San Francisco Democratic County Central Committee	Alexandra Medina
119	San Francisco Parks Alliance	Matthew O'Grady
120	San Francisco Parks Alliance	Rachel Norton

Recipients of 2020 UWMP Update Notification
(Sent via e-mail on January 29, 202, February 8, 2021 and March 12, 2021)

121	San Francisco Republican Central Committee	Mike Denunzio
122	San Francisco Republican County Central Committee	Christine Hughes
123	San Francisco Small Business Network	Pat Christensen
124	San Francisco Tomorrow	Jennifer Clary
125	San Francisco Tomorrow	Jennifer Clary
126	Sierra Club	Ruth Gravanis
127	Sierra Club, San Francisco Bay Chapter	Michelle Meyers
128	Small Business Network	Paul Pendergast
129	Southeast Community Facility	Toye Moses
130	SPUR	Laura Tam
131	Sunset Beacon/Richmond Review	Paul Kozakiewicz
132	Sunset Heights Associaton of Responsible People	J. Barry
133	Sunset Neighborhood Beacon Center	Matt Pemberton
134	Sunset Parkside Education and Action Committee (SPEAK)	Marc Duffet
135	Sunset Parkside Education and Action Committee (SPEAK)	Marc Duffett
136	Taraval Parkside Merchants Association	Yumi Sam
137	Tuolumne River Trust	Peter Drekmeier
138	Urban Resource Systems	Isabel Wade
139	West of Twin Peaks Central Council	Roger Ritter
140	West of Twin Peaks Observer	Mitch Bull
141	Westwood Park Association	Kate Favetti
142	Presidio Trust	Craig Middleton
143	Presidio Trust	Mark Hurley
144	Presidio Trust	Paula R. Collins
145	City College of San Francisco	Robert Gabriner
146	Mayor's Office of Neighborhood Services	David Miree
147	Port of San Francisco	Monique Moyer
148	San Francisco Board of Supervisors	Aaron Peskin
149	San Francisco Board of Supervisors	David Campos
150	San Francisco Board of Supervisors	Eric Mar
151	San Francisco Board of Supervisors	Jane Kim
152	San Francisco Board of Supervisors	John Avalos
153	San Francisco Board of Supervisors	Katy Tang
154	San Francisco Board of Supervisors	London Breed
155	San Francisco Board of Supervisors	Malia Cohen
156	San Francisco Board of Supervisors	Mark Farrell
157	San Francisco Board of Supervisors	Norman Yee
158	San Francisco Board of Supervisors	Scott Wiener
159	San Francisco Department of Building Inspection	Lily Madjus-Wu
160	San Francisco Department of Building Inspection	Tom Hui
161	San Francisco Department of Public Health	Barbara Garcia

162	San Francisco Department of Public Works	Mohammed Nuru
163	San Francisco Department of the Environment	Debbie Raphael
164	San Francisco Fire Department	Joanne Hayes-White
165	San Francisco International Airport	John Martin
166	San Francisco International Airport	Mark Costanzo
167	San Francisco Municipal Transportation Agency	Edward Reiskin
168	San Francisco Office of Community Investment and Infrastructure	Darshan Singh
169	San Francisco Office of Community Investment and Infrastructure	Tiffany Bohee
170	San Francisco Office of Small Business	Regina Dick-Endrizzi
171	San Francisco Office of the City Attorney	Dennis Herrera
172	San Francisco Planning Department	Gil Kelley
173	San Francisco Planning Department	John Rahaim
174	San Francisco Planning Department	Sarah B. Jones
175	San Francisco Public Library	Luis Herrera
176	San Francisco Recreation and Park Department	Dennis Kern
177	San Francisco Recreation and Park Department	Phil Ginsburg
178	San Francisco Sheriff's Department	Vicki L. Hennessy
179	SFPUC Citizens' Advisory Committee (CAC)	Amy Zock
180	SFPUC Citizens' Advisory Committee (CAC)	Art Taylor
181	SFPUC Citizens' Advisory Committee (CAC)	Avni Jamdar
182	SFPUC Citizens' Advisory Committee (CAC)	Eli Saddler
183	SFPUC Citizens' Advisory Committee (CAC)	Jennifer Clary
184	SFPUC Citizens' Advisory Committee (CAC)	Kelly Groth
185	SFPUC Citizens' Advisory Committee (CAC)	Marjorie Goodwin
186	SFPUC Citizens' Advisory Committee (CAC)	Mark Connors
187	SFPUC Citizens' Advisory Committee (CAC)	Rebecca Lee
188	SFPUC Citizens' Advisory Committee (CAC)	Shalini Swaroop
189	SFPUC Citizens' Advisory Committee (CAC)	Suki Kott
190	SFPUC Citizens' Advisory Committee (CAC)	Tamar Barlev
191	SFPUC Citizens' Advisory Committee (CAC)	Ted Loewenberg
192	SFPUC Citizens' Advisory Committee (CAC)	Tracy Zhu
193	SFPUC Citizens' Advisory Committee (CAC)	Wendolyn Aragon
194	Sunshine Ordinance Task Force	Louise Fischer

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

NOTICE OF PUBLIC HEARING Tuesday, April 13, 2021 - 1:30pm at a Regular Meeting of the San Francisco Public Utilities Commission (SFPUC), the governing board of the publicly owned utility operations of the City and County of San Francisco: Notice is hereby given that the SFPUC will conduct a public hearing to consider the Draft 2020 Urban Water Management Plan (UWMP) for the City and County of San Francisco. The detailed agenda and related files will be available at least 72 hours before the scheduled meetings at the SFPUC website: www.sfwater.org or by calling (415) 554-3165. The hearing will be held virtually and can be accessed using the following information: Watch the meeting live: https://www.sfgovtv.org/sfpuc. Call-in number: 1 (415) 655-0001 / MEETING ID: 146 929 4145 # #

All interested parties are invited to attend the public hearing and present their views. Persons who are unable to attend the public hearing may also submit written comments regarding the subject of the hearing. These comments will be brought to the attention of the Commission and will become part of the official public record. Written comments can be delivered to SFPUC in one of three ways:

1) Emailed to Sarah Triolo, striolo@sfwater.org.
2) Mailed to the following address: Steve Ritchie, SFPUC, 525 Golden Gate Avenue, 13th Floor, SF, CA 94102.
3) Deposited in the drop box at 525 Golden Gate Avenue. Comments submitted via the drop box must be in an envelope with the following information clearly printed: “Urban Water Management Plan Comments, c/o Sarah Triolo”.

The Draft 2020 UWMP can be viewed and printed from the SFPUC website at: https://sfpuc.org/uwmp.

APPENDIX D

SB X7-7 Compliance Form

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

SB X7-7 Table 0: Units of Measure Used in 2020 UWMP* *(select one from the drop down list)*
Acre Feet
**The unit of measure must be consistent throughout the UWMP, as reported in Submittal Table 2-3.*
NOTES: The units of measure used in the body of the UWMP are millions of gallons per day (mgd).

SB X7-7 Table 1 pertains to baselines and targets and is not used in the SB X7-7 2020 Compliance Form.

SB X7-7 Table 2: Method for 2020 Population Estimate	
Method Used to Determine 2020 Population (may check more than one)	
☑	**1. Department of Finance** (DOF) or **American Community Survey** (ACS)
☑	**2. Persons-per-Connection Method**
☐	**3. DWR Population Tool**
☑	**4. Other** DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: 2020 Service Area Population	
2020 Compliance Year Population	
2020	899,732
NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.	

SB X7-7 Table 4: 2020 Gross Water Use

Compliance Year 2020	**2020 Volume Into Distribution System** *This column will remain blank until SB X7-7 Table 4-A is completed.*	**2020 Deductions**					**2020 Gross Water Use**
		Exported Water *	**Change in Dist. System Storage*** (+/-)	**Indirect Recycled Water** *This column will remain blank until SB X7-7 Table 4-B is completed.*	**Water Delivered for Agricultural Use***	**Process Water** *This column will remain blank until SB X7-7 Table 4-D is completed.*	
	76,730	-	-	-	-	-	**76,730**

*** Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	Regional Water System
This water source is *(check one)*:	
☑	The supplier's own water source
☐	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	74,260	-	74,260

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.*

[2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s) Meter Error Adjustment

Complete one table for each source.

Name of Source	Groundwater
This water source is *(check one)*:	
☑	The supplier's own water source
☐	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	2,470	0	2,470

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.*

[2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES: Groundwater use has found to be constant throughout the years, which consists of 1.5 mgd (1,680 AF) of in-city irrigation use, another 0.4 mgd (450 AF) of in-city potable water production, and 0.3 mgd (340 AF) for Castlewood CSA.

SB X7-7 Table 5: 2020 Gallons Per Capita Per Day (GPCD)		
2020 Gross Water ***Fm SB X7-7 Table 4***	**2020 Population** ***Fm SB X7-7 Table 3***	**2020 GPCD**
76,730	899,732	**76**

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 6 pertains to baselines and targets and is not used in the SB X7-7 2020 Compliance Form.

SB X7-7 Table 7 applies to baselines and targets and is not used in the SB X7-7 2020 Compliance Form.

SB X7-7 Table 8 was used for the 2015 Interim Target and is not used in the 2020 UWMP.

SB X7-7 Table 9: 2020 Compliance

Actual 2020 GPCD[1]	Optional Adjustments to 2020 GPCD					2020 Confirmed Target GPCD [1, 2]	**Did Supplier Achieve Targeted Reduction for 2020?**
	Enter "0" if Adjustment Not Used			TOTAL Adjustments[1]	Adjusted 2020 GPCD [1] *(Adjusted if applicable)*		
	Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]				
76	-	-	-	-	76	96	**YES**

[1] *All values are reported in GPCD*

[2] ***2020 Confirmed Target GPCD** is taken from the Supplier's SB X7-7 Verification Form Table SB X7-7, 7-F.*

NOTES:

SFPUC RETAIL BASELINES AND TARGETS NARRATIVE

With the adoption of the Water Conservation Act of 2009, also known as SB X7-7, the State was required to set a goal of reducing urban water use by 20% by the year 2020. Each retail urban water supplier was required to determine its baseline water use, expressed in gallons per capita per day (GPCD) during its baseline period, as well as its target water use for the years 2015 and 2020 in order to help the State achieve the 20% reduction.

In its 2010 UWMP, the SFPUC first established the baseline per capita water use, as well as the interim (i.e. 2015) and 2020 water use targets. In the 2015 UWMP, the SFPUC performed a detailed analysis to update the baseline and target per capitas based on in-City retail service area population and water use. The 2015 UWMP analysis by (1) revising the population of the in-City retail service area to reflect the 2010 U.S. Census rather than the 2000 U.S. Census, and (2) including the population and water use of the suburban retail service area. The baseline and targets established in 2015 do not need to be updated. This section provides a summary of the 2015 analysis and shows the SFPUC's compliance with the 2020 target.

Note that water use presented in this section reflects gross water use (i.e., water use by all sectors, including water loss). A complete set of standardized SB X7-7 Verification Form tables prescribed by DWR is provided Appendix D. Additionally, Groveland CSD is not included in this section, as explained in Section 2.4.

1.1 PER CAPITA WATER USE BASELINE CALCULATIONS

As described in DWR's *Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use For the Consistent Implementation of the Water Conservation Act of 2009*, the Water Conservation Act of 2009 requires that each urban retail water supplier include in its UWMP an estimate of base daily per capita water use, expressed in GPCD, for a continuous multi-year base period. The California Water Code (CWC) specifies two different base periods:

- A continuous 10-year period, used to calculate baseline per capita water use, which may be extended up to an additional 5 years to a maximum of a continuous 15-year period for an urban retail water supplier that meets at least 10 percent of its retail water demand through recycled water, per CWC Section 10608.12(b)(1) and (2).

- A continuous five-year period, used to determine whether the 2020 per capita water use target meets the legislation's minimum water use reduction requirement, per CWC Section 10608.12(b)(3).

Because the SFPUC's current and past recycled water use does not equal or exceed 10% of retail water demand, the 15-year period cannot be used to calculate baseline per capita water use. The SFPUC will utilize a 10-year baseline period. Water use data from 2001 to 2010 have been used for this analysis, which is consistent with the baseline period used in the previous analysis in the 2010 UWMP.

Base daily per capita water use has been calculated for the 10-year baseline period as follows:

- Step 1: Estimate Distribution System Area. The distribution system area refers to the in-City and suburban retail areas, as described in Section 3.2.

- Step 2: Estimate Service Area Population for Base Period. The retail population was estimated for the period of 2001 to 2010 based on various sources depending on data availability. For the in-City retail service area, population data were obtained from the California Department of Finance for the County of San Francisco. However, the same method could not be used for the suburban retail service area since the service area does not align with municipal boundaries. Therefore, the SFPUC consulted with DWR (i.e., pre-review) on an appropriate, alternate methodology based on U.S. Census data at the census block level and persons-per-household data. Use of persons-per-household data was deemed adequate since it is assumed that all residential accounts serve single family homes in the suburban retail service area, and no multi-family residences are served. Therefore, the number of connections can be considered equivalent to number of households. For the Town of Sunol specifically, the SFPUC used the web-based DWR Population Tool since the corresponding service area was difficult to define at the census block level (output provided in Appendix H). The resulting retail population estimates are shown in Table 5-1.

- Step 3: Calculate Gross Water Use. Gross water use is summarized in
- Table 0-2. Gross water use is comprised of water from the SFPUC's own water supply sources delivered to all retail customers. Changes in storage were then factored in to develop gross water use. The SFPUC compiles daily flow data for the County-line, system input, and in-line meters, as well as daily reservoir water level data. The meters, water level sensors, and associated metering equipment are all inspected, tested, calibrated, and maintained according to the applicable meter calibration and maintenance frequency by an independent metering consultant. These include annual pitot tube tests, quarterly secondary meter equipment testing and calibration, cleaning, flushing, inspecting, and lubricating. The flow quantities are expected to be accurate and no meter error adjustment is necessary.

- Step 4: Calculate Annual Daily Per Capita Water Use. Annual daily per capita water use was calculated by dividing gross water use by population. Annual daily per capita water use is shown in Table 0-3.

- Step 5: Calculate Base Daily Per Capita Water Use. Base daily per capita water use is calculated as the average of per capita water use, or 107 GPCD as shown in Table 0-3.

Table 0-1. Retail Population for 10-Year and Five-Year Baselines

[SB X7-7 Verification Form Table 3: Service Area Population]

10-Year Baseline	Five-Year Baseline	Year	Service Area Population		
			In-City Retail[a]	Suburban Retail[c]	Total Retail
Year 1	—	2001	780,614	1,634	782,248
Year 2	—	2002	782,765	1,633	784,398
Year 3	—	2003	782,599	1,630	784,229
Year 4	—	2004	781,308	1,626	782,934
Year 5	—	2005	780,187	1,619	781,806
Year 6	Year 1	2006	781,295	1,611	782,906
Year 7	Year 2	2007	787,127	1,786	788,913
Year 8	Year 3	2008	795,002	1,773	796,775
Year 9	Year 4	2009	800,239	1,751	801,990
Year 10	Year 5	2010	805,235	1,747	806,982
2020 Compliance Year			897,806	1,926	899,732

a In-City population estimated as County of San Francisco population obtained from the California Department of Finance Report E-8: Historical Population and Housing Estimates for Cities, Counties, and the State, 2000-2010, released September 2012. Population data for 2001 through 2009 are for January 1 of the applicable year, whereas population data for 2010 is for April 1, 2010 per the revised 2010 decennial census count.

b In-City population estimated as County of San Francisco population obtained from the California Department of Finance Report E-5: Population and Housing Estimates for Cities, Counties, and the State, 2011-2020 with 2010 Census Benchmark, released May 2020. Population data corresponds to January 1, 2020.

c Suburban retail population based on estimates for the Town of Sunol, Redwood City, Daly City, Fremont, Millbrae, Castlewood CSA, and San Francisco County Jail #5. Groveland CSD is not included.

1) Population of retail customers in the Town of Sunol was estimated using the DWR Population Tool. Output from the tool is provided in Appendix H.
2) Populations of retail customers in Redwood City, Daly City, Fremont, Millbrae, and Castlewood were estimated using data from the 2000 and 2010 U.S. Census at the census block level.
3) Inmate population of the San Francisco County Jail #5 in San Bruno was provided by staff of the San Francisco Sheriff's Department.
4) Other suburban customers include individual research and commercial facilities, such as the Lawrence Livermore National Lab, San Francisco International Airport, National Aeronautics and Space Administration, etc. Because these are non-residential facilities, their population is assumed to be zero.

Table 0-2. Retail Gross Water Use for 10-Year and Five-Year Baselines

[SB X7-7 Verification Form Table 4: Annual Gross Water Use]

10-Year Baseline	Five-Year Baseline	Year	Volume Into Distribution System[a]	Deductions					Annual Gross Water Use [c]
				Exported Water	Change in Storage[b]	Indirect Recycled Water	Water Delivered for Agricultural Use	Process Water	
Year 1	—	2001	90.9	0	-0.01	0	0	0	91.0
Year 2	—	2002	91.2	0	0.00	0	0	0	91.2
Year 3	—	2003	88.0	0	0.15	0	0	0	87.9
Year 4	—	2004	85.6	0	0.02	0	0	0	85.6
Year 5	—	2005	85.6	0	-0.09	0	0	0	85.7
Year 6	Year 1	2006	83.9	0	0.00	0	0	0	84.0
Year 7	Year 2	2007	82.3	0	0.03	0	0	0	82.3
Year 8	Year 3	2008	80.6	0	0.00	0	0	0	80.6
Year 9	Year 4	2009	78.8	0	-0.01	0	0	0	78.8
Year 10	Year 5	2010	76.9	0	0.06	0	0	0	76.8
10-Year Baseline Average Gross Water Use									84.4
Five-Year Baseline Average Gross Water Use									80.5
2020 Compliance Year									68.5

a All sources are metered, and all meters are calibrated annually.

b Changes in distribution system storage were estimated based on storage records of all in-City storage. Most suburban retail systems do not have storage facilities or the changes in storage were found to be negligible.

c The annual gross water use does not include water supplied to Groveland CSD.

Table 0-3. Retail Gross Per Capita Water Use for 10-Year and Five-Year Baselines

[SB X7-7 Verification Form Table 5: Gallons Per Capita Per Day (GPCD)]

10-Year Baseline	Five-Year Baseline	Year	Service Area Population	Annual Gross Water Use (mgd)	Daily Per Capita Water Use (GPCD)
Year 1	—	2001	782,248	91.0	116
Year 2	—	2002	784,398	91.2	116
Year 3	—	2003	784,229	87.9	112
Year 4	—	2004	782,934	85.6	109
Year 5	—	2005	781,806	85.7	110
Year 6	Year 1	2006	782,906	84.0	107
Year 7	Year 2	2007	788,913	82.3	104
Year 8	Year 3	2008	796,775	80.6	101
Year 9	Year 4	2009	801,990	78.8	98
Year 10	Year 5	2010	806,982	76.8	95
10-Year Baseline Average GPCD					107
Five-Year Baseline Average GPCD					101
2020 Compliance Year					76

1.2 GROSS PER CAPITA WATER USE TARGETS CALCULATIONS

Consistent with its 2010 UWMP, the SFPUC used Method 3 of the four approved methods provided by the Water Conservation Act of 2009 for determining urban water use targets in 2015. The SFPUC's retail service area is contained entirely within the San Francisco Bay hydrologic region. The hydrologic region baseline, interim, and 2020 targets are 157, 144, and 131 GPCD, respectively. To calculate the urban water use targets using Method 3, 95% of the 2015 interim and 2020 targets are calculated, yielding 2015 interim and 2020 targets of 137 and 124 GPCD, respectively.

In the event that the five-year baseline exceeds the 100-GPCD threshold specified in CWC Section 10608.22, the 2015 and 2020 per capita water use targets shall be verified to determine whether they meet the minimum water use reduction requirements, which warrant that an urban retail water supplier's 2020 target shall be at least 95% of the five-year baseline per capita water use. The SFPUC's daily per capita water use for the five-year period from 2006 to 2010 is 101 GPCD. Because it is above the 100-GPCD threshold specified by the CWC, the 2020 target must be adjusted to reduce water use by a minimum of 5% of the five-year baseline, or 5 GPCD. As such, the SFPUC's highest allowable 2020 target is 96 GPCD (initial 2020 target of 101 GPCD minus the adjustment of 5 GPCD). Since the highest allowable 2020 target is less than the target calculated using Method 3, the SFPUC's 2020 target is adjusted to 96 GPCD. The resulting 2015 interim target was 102 GPCD (i.e., the midpoint between the 10-year baseline of 107 GPCD and the 2020 target of 96 GPCD) (see Table 0-4).

Table 0-4. Gross Per Capita Water Use Baselines and Targets Summary (GPCD)

[Standardized Table 5-1: Baselines and Targets Summary]

Baseline Period	Start Year	End Year	Average Baseline	Interim 2015 Target	Confirmed 2020 Target
10–Year Baseline	2001	2010	107	102	96
Five-Year Baseline	2006	2010	101	—	—

1.3 COMPLIANCE WITH 2020 DAILY PER CAPITA WATER USE TARGET

As shown in Table 0-3, with a 2020 per capita water use of 76 GPCD, the SFPUC is in compliance with its 2020 target of 96 GPCD. No adjustments were needed.

Taking into consideration the impact of population and employment growth, as well as passive and active conservation efforts, the SFPUC initially projected in 2015 that its 2020 daily per capita water use would be approximately 86 GPCD. With its continued water conservation program, the SFPUC has achieved a lower than initially predicted per capita water use with a 2020 per capita water use of 76 GPCD, in compliance with the final 2020 target of 96 GPCD.

1.4 ASSISTANCE TO WHOLESALE CUSTOMERS

As a wholesale supplier, the SFPUC is required to provide an assessment of present and proposed future measures, programs, and policies that will help the retail water suppliers in their wholesale service area to achieve their water use reduction targets. This is further discussed in Section 10.3.

APPENDIX E

2020 Retail Demand Model and Projections Technical Memorandum

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

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Water Demand Forecast for the City of San Francisco

2020-2045

PREPARED BY

David Sunding
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PREPARED FOR

The San Francisco Public Utilities Commission

MARCH 26, 2021

Services of the San Francisco Public Utilities Commission

NOTICE

- This report was prepared for the San Francisco Public Utilities Commission, in accordance with The Brattle Group's engagement terms, and is intended to be read and used as a whole and not in parts.
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TABLE OF CONTENTS

TABLE OF TABLES

Executive Summary

The San Francisco Public Utilities Commission (SFPUC) commissioned the Brattle Group to forecast water demand within SFPUC's in-City retail service area, encompassing the City and County of San Francisco (CCSF). We forecast demand for the following three types of accounts within the in-City retail service area:

- Single-Family Residential,
- Multi-Family Residential, and
- Commercial and Industrial.

To forecast future water demands, we obtained data on monthly water consumption and billing for each account of the above types in the City and County of San Francisco. We merged this data with property characteristics held by the Office of the Assessor-Recorder, demographic characteristics from the American Community Survey at the census block-group level, and historical climate data from the PRISM dataset.

We forecast account-level water demand based on each household's or business's historical average water consumption and statistical relationships between each household's water consumption and demand drivers such as water rates, weather, and other factors such drought and the COVID-19 pandemic. For each account, we estimate the relationship between water use and these demand factors using a multiple regression analysis. In a regression analysis, changes in the dependent variable, namely account-level water use, are explained by the control variables such as rates, climate, and macro-economic factors. The statistical estimates are not based on differences in the average level of water use between accounts, which we adjust for using as a statistical technique called 'fixed-effects'. Rather our estimates are based on the different trends in how each account's water use changes in response to changes in rates, climate and macro-economic factors.

The results of our statistical model are a set of "demand elasticities" with respect to water rates, average monthly average temperature, and monthly precipitation. These elasticities describe the percentage change in water consumption predicted in response to a one-percentage change in each of these control variables. The models also produce the estimated change in water use for each type of account during the COVID-19 pandemic and periods of drought.

For each account, future demand from 2020 to 2045 is forecast based on the historical aggregate water use for each account, and expected future changes in rates and climate. The assumptions for future rates and climate were developed in consultation with SFPUC. The forecasts assume that by 2045 water rates increase by 50% in real terms (i.e., after controlling for inflation), average temperatures in San Francisco increase 1.1°C, and average precipitation is unchanged. We forecast demands for normal years by removing the estimated impact of drought and the ongoing COVID-19 pandemic.

Total demand for the in-city retail service area is calculated by aggregating the monthly account-level forecasts by the number of units and businesses. In addition to the existing stock of residential and commercial accounts, San Francisco's Urban Water Management Plan assumes significant growth in both the number of multiple-family homes and employment within the City based on housing and employment forecasts provided by the San Francisco Planning Department. The forecast incorporates approximately 5,100 new multi-family residential units each year with a simulation that assumes that newly built buildings have the same number of units and per-unit level of consumption as similar existing buildings that have been built in San Francisco since 1990. This approach implicitly assumes that these new multifamily units adopt the current standards in water-efficient plumbing fixtures. The forecast incorporates employment growth of approximately 5,000 jobs per year, split across five different land-use types.[1] The forecast assumes that new commercial and industrial accounts have the same water use patterns as similarly sized existing firms with the same land-use category.

Table 1 summarizes our forecasts. By 2045, single-family residential consumption is forecast to fall to 13.54 million gallons per day; multi-family residential consumption is forecast to grow to 33.03 million gallons per day; and commercial and industrial consumption will remain approximately flat at 18.00 million gallons per day. These forecasts account for all single-family, multi-family, and commercial/industrial water use in the SFPUC retail service area, including fire accounts and combination accounts. However, these forecasts do not include water losses or other account types such as suburban retail accounts, irrigation accounts, or municipal accounts.

In 2015, The Brattle Group produced demand forecasts for SFPUC as part of the previous Urban Water Management Planning process. The model in this memo departs in several important ways from the model that we previously used to forecast water demand in San Francisco. First, the previous model was calibrated to 2010 levels of demand, which are out of date and significantly higher than current consumption. Second, San Francisco's forecasts for future housing and employment growth have changed substantially; the San Francisco Planning Department now expects zero growth in single-family units, but significant growth in multi-family units and in-city employment. Third, our statistical model relies on different data and a different estimation strategy. The new model is estimated from variation over-time in consumption within each individual account in the SFPUC retail service area, whereas the previous model was estimated based on a cross-section of aggregated city-level observations across the

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[1] Employment forecasts and the five different types of land-use categories come from the Plan Bay Area produced by the Association of Bay Area Governments. The five different types of land-use are: Office/Professional; Health/Education/Recreation; Manufacturing/Wholesale; Retail/Restaurants; and Other.

Regional Water System service area (i.e., the BAWSCA agencies and the City and County of San Francisco). Fourth, our model now explicitly adjusts for savings from active conservation programs and non-potable / onsite reuse in SFPUC's water conservation model.[2] Fifth, our previous model assumed that water consumption depends on household income levels as a proxy for each account's housing size and type, which we did not have individual-level data for our previous analysis. The model in this memo instead directly adjusts for every existing account's average water and forecasts the water use of homes built in the future.

TABLE 1: SUMMARY OF FORECASTS BY SECTOR

		FY2019-20 (Actual)	FY2019-20 (Forecast)	FY2024-25	FY2029-30	FY2034-35	FY2039-40	FY2044-45
					(millions of gallons per day)			
Single Family Residential								
Raw Prediction		14.45	14.32	13.83	13.63	13.60	13.63	13.65
Conservation:	*Active*	0.00	0.00	-0.15	-0.18	-0.17	-0.13	-0.11
Total		14.45	14.32	13.68	13.45	13.43	13.49	13.54
Multifamily Residential (5100 new units / year)								
Raw Prediction		22.91	22.47	24.03	26.14	28.65	31.32	33.99
Conservation:	Active	0.00	0.00	-0.15	-0.20	-0.18	-0.11	-0.06
	Non-Potable / Onsite Reuse	-0.07	-0.07	-0.21	-0.35	-0.63	-0.91	-0.91
Other Accounts:	*Fire*	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total		22.85	22.41	23.68	25.60	27.85	30.31	33.03
Commercial and Industrial								
Raw Prediction		14.70	17.81	17.25	17.33	17.49	17.93	18.38
Conservation:	*Active*	0.00	0.00	-0.28	-0.30	-0.30	-0.28	-0.23
	Non-Potable / Onsite Reuse	-0.03	-0.03	-0.09	-0.15	-0.27	-0.39	-0.39
Other Accounts:	*Docks / Ships*	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	Builders / Contractors	0.14	0.18	0.18	0.18	0.18	0.18	0.18
	Fire	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total		14.86	18.02	17.12	17.11	17.16	17.51	18.00
Grand Total		52.15	54.75	54.47	56.16	58.44	61.31	64.57

Notes:

The FY2019-20 (Actual): This column is a forecast that reflects actual demands under the prevailing COVID-19 and weather conditions and perfectly matches with realized demand.

The FY2019-20 (Forecast): This column is a forecast that assumes no COVID-19 pandemic and average weather conditions.

Raw Prediction: This is the raw output of Brattle's statistical forecast. In each sector, this category includes both standard accounts and combination-fire accounts.

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[2] Onsite water reuse savings result from buildings installing and operating onsite water reuse systems. These systems involve the collection, treatment, and reuse of alternate water sources such as blackwater, graywater, and foundation drainage for non-potable end uses such as toilet flushing and irrigation. The water supplies produced by these systems are not municipally-supplied by the SFPUC and thus they serve to reduce demands on SFPUC's system.

Conservation Adjustment: This is the output of the SFPUC Conservation model. This value accounts for estimated water savings from the SFPUC's active conservation program and on-site and non-potable water reuse program. Passive conservation savings from plumbing code are already assumed/reflected in the raw demand projections.

Residential Fire Accounts: These values were supplied by SFPUC

Commercial and Industrial – Other: This category includes Docks and Ships; Builders/Contractors; and Non-Residential Fire Accounts. These values were supplied by SFPUC.

Grand Total: This row does not include water losses, suburban accounts, irrigation accounts or municipal accounts.

I. Methodology

Our estimation process has several steps that we discuss in the respective subsections below. First subsection discusses the raw data that we collect and how we pre-adjust our raw data to remove the impact of SFPUC's active water conservation programs, which we account for separately after forecasting future demand. The second section discusses the econometric model that we estimate. The third sub-section discusses the assumptions and calculations that we use to produce both individual-level and aggregate demand estimates from the econometric model.

A. Data

1. Data Sources and Construction

Our estimates rely on account-level data from SFPUC's retail service area, matched with data on parcel characteristics, and local weather fluctuations. We matched SFPUC's monthly billing data to publicly available data on land-use and building characteristics based on addresses provided in San Francisco's 2017 Tax Assessor and 2016 Land Use data. We then used these parcels to add characteristics about each meter from the public Tax Assessor, and Land Use data, as well historical weather data from the University of Oregon State's PRISM dataset, US Census block-group characteristics from the 2018 American Community Survey, US Census tract characteristics from the 2010-2019 American Community Survey, and Employment and Land Use forecasts provided by the SFPUC.

San Francisco's public agencies do not keep a data key that links information between the parcel identifiers in the Tax Assessor's records and the account numbers used in SFPUC's records. Therefore, to merge assessor information into our dataset, we matched accounts based on their reported addresses. Due to inconsistencies in address reporting between the two datasets, we could not match all records; however, we managed to match over 95% of all accounts. Based on a comparison of summary statistics between all accounts and only matched summary statistics, these accounts appear to be a representative sample, and therefore, we are confident using these data as the basis for our forecast model.

We use climate data from the University of Oregon State's PRISM Climate Group.[3] This dataset gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal short- and long-term climate patterns. We use a dataset of monthly average temperature and precipitation at a resolution of 800m x 800m. These

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[3] https://prism.oregonstate.edu/

datasets' spatial resolution allow us to identify microclimates at a high spatial resolution within San Francisco and identify how these microclimates affect water use.

From the assessor's parcel data, we can match each account up with the land-use category of the property on which it lies. The ABAG Plan Bay Area forecasts the total employment between 2005 and 2045 within each TAZ (transportation assessment zone), a unit of geography about the size of a zip-code. Within each TAZ, Plan Bay Area forecasts employment in each of five sectors: 1) Retail / Restaurants; 2) Financial and Professional Services; 3) Health, Education and Recreational Services; 4) Manufacturing, Wholesale Trade and Transportation; and 5) Other Categories.

Consumption data is also matched to past rate data and forecasted future rate increases out to 2045, which were provided to us by the finance department at SFPUC. All of the rates in our data are adjusted for inflation to 2020 dollars using CPI data from the St. Louis Federal Reserve's Economic Data (FRED).

2. Remove Water Conservation Policy from Raw Data

In addition to these fundamental determinants, we also explicitly adjust the forecast demand based on expected future water conservation from active water conservation programs run by SFPUC and from non-potable and onsite water reuse programs. This approach of explicitly accounting for active conservation programs in demand forecasts has been advocated as best practice by local researchers and advocacy groups[4]. However, explicitly adjusting for water conservation introduces some challenges into the demand estimation process. Specifically, care needs to be taken not to double-count savings from conservation programs with consumers' responses to rates, drought and climate. To do this, we adjust our historical data, by adding back in the savings that SFPUC estimates have been generated as a result of their active conservation programs. Savings for water conservation are calculated at an aggregate level, but we split these savings down to the household level by calculating the share of conservation attributable to each household and adding these savings back onto each household's daily water use.[5]

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4 Diringer, Sarah E., Heather Cooley, Matthew Heberger, Rapichan Phurisamban, Andrea Turner, John McKibbin, and Mary Ann Dickinson. 2018. Integrating Water Efficiency Standards and Codes into Long-Term Demand Forecasting. Water Research Foundation.

Abraham, Sonali, Sarah Diringer, and Heather Cooley. 2020. An Assessment of Urban Water Demand Forecasts in California. Oakland, Calif.: Pacific Institute.

[5] Although we make explicit adjustments for active water conservation programs, demand for which is driven my SFPUC outreach, we do not make a similar adjustment for passive water saving. Passive water savings are primarily driven consumers' changing their water consumption behavior to in response to changes in rates, and so are implicitly accounted for in our demand elasticity estimates. Including an explicit adjustment for these savings would risk double-counting and underestimating future water use.

After adding these savings back in, we arrive at an estimate of “pre-conservation” demand, which describes what demand would have been but-for SFPUC’s conservation programs. We estimate our statistical demand model and predict demand based on this “pre-conservation” data.

Future demand reduction as a result of onsite water reuse systems was also incorporated into the multi-family and commercial sector models. Estimates of future reductions were provided by SFPUC staff and were subtracted off the raw demand forecasts. In the last step of our analysis, we add back in thedr active conservation savings and savings from reuse and non-potable water programs to generate the final demand estimate.

B. Econometric Model

To predict how water demand in SFPUC’s retail service area will change over time, it is necessary to estimate a relationship between water use and the demand factors used in this analysis (e.g., rates and climate). Generally, water use and water price are negatively correlated. In other words, as water becomes more expensive, users will reduce their demands to offset the higher costs. As temperature increases or precipitation decreases, water demand is expected to increase.

For each account, we estimate the relationship between water use and these demand factors using a regression analysis with account-level fixed effects. In a regression analysis, changes in the explanatory variable, customer water use, are explained by the dependent variables, such as rates, climate, and macro-economic factors. In a regression with account-level fixed effects, we also control for the average level of water consumption for every premise in the retail service area. All explanatory variables in our empirical model are estimated in natural logarithms, which allows us to interpret their corresponding regression coefficients as elasticities.

An elasticity is the relationship between a variable, such as price, and water demand, which is calculated and interpreted as the percent change in water demand for a given percent change in the variable, water price. For example, a price elasticity of -0.2 implies that users reduce water demand by 0.2% for each 1% increase in price. We estimate similar elasticities with respect to elements of weather and climate such as temperature and precipitation. These elasticities can be used to estimate the impact of anticipated future climate change.

To estimate demand for single-family and multi-family water use, we estimate the follow equation, for multi-family homes q_{it} is the average water use per unit.

$$\ln(q_{it}) = \ln(rate_t)\beta^{rate} + \ln(temp_{it})\beta^{temp} + \ln(ppt_{it})\beta^{ppt} + \gamma^{COVID} + \gamma^{drght} + \gamma_i + \varepsilon_{it}$$

Where, the dependent variable, $\ln(q_{it})$, is the natural logarithm of household i’s pre-conservation water consumption in month t. Dependent Variables:

- **Monthly Rate $rate_t$:** The volumetric rate paid by households in each month.
- **Weather $temp_{it}$ and ppt_{it}:** We obtain panel of modelled 800m x 800m climate characteristics from PRISM[6]. We control for each months' average precipitation and mean temperature.
- **Drought and COVID-19 Emergencies γ^{drght} and γ^{COVID}:** We include fixed effects, dummy variables which take on the value 0 or 1, during the 2015 to 16 drought, and during the COVID-19 pandemic beginning March 2020. These coefficient estimates on these dummy variables can be interpreted as the average change in the natural logarithm of water use during periods of drought and COVID-19, relative to periods without these factors.
- **Individual Fixed Effects $\boldsymbol{\gamma_i}$:** Using this high-resolution data, we can control for the average level of water use for each account in our data. Controlling for the average level of our water use within each household allows us to estimate how an individual account responds to changes in rates, rather than identifying our estimates based on a cross-sectional difference in water consumption.
- **Idiosyncratic error term $\boldsymbol{\varepsilon_{it}}$**: This term is standard in statistical regression analysis and is used to rationalize unexplained variation in the model. The model coefficients β are chosen to minimize the idiosyncratic error. The variance of ε_{it} is a key factor that is used to calculate the 95% confidence interval that characterizes the uncertainty associated with the model's parameters estimates β. We adopt two-way cluster-robust method, clustered at the census block-group and year level to account for unexplained correlations in water use either within years or within neighborhoods.

To estimate demand for commercial and industrial accounts we use the following equation:

$$\ln\left(q_{ijt}\right) = \ln(\,rate_t)\beta_j^{rate} + \ln(temp_{it})\beta^{temp} + \ln(ppt_{it})\beta^{ppt} + \gamma_j^{COVID} + \gamma^{drght} \; + \gamma_i + \varepsilon_{it}$$

This specification is the same as for the residential model, except the key differences is that the parameter estimates for rates β_j^{rate} and for COVID-19 γ_j^{COVID} are allowed to vary by land-use with a different parameter being chosen in each different type of land-use in the commercial and industrial sector.

C. Forecast Data

1. Forecast Assumptions

Table 2 and Table 3 summarize the assumptions that we adopt in our forecast. Assumptions about growth in the number of single-family and multi-family units comes from the San Francisco Planning Department. Assumptions for the number of employees are from the Plan Bay Area out to the year 2045. Assumptions about future climate are based on the average of outcomes across multiple

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[6] PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, accessed 20 October 2020.

profession elicitations and climate change models specific to the San Francisco Peninsula considered by SFPUC's Long Term Vulnerability Assessment.

For each existing account, we then forecast demand from 2020 to 2045 based on the historical aggregate water use for each account, and expected future changes in rates and climate. Our forecasts assume that by 2045 water rates increase by 50% in real terms; that average temperatures in San Francisco increase 1.1°C, and that precipitation is unchanged.

In addition to our central climate forecast, we also tested the robustness of our results to two alternative climate-change scenarios. In footnotes, we have reported the unadjusted baseline demand per-unit, noting that these alternative scenarios did not substantially change the results.[7]

In addition to forecasting demand for existing accounts, we also need to account for growth from new accounts, including newly constructed multifamily units and employment growth in the non-residential sector. The forecast incorporates approximately 5,100 new multiple-family residential units each year with a simulation that assumes that newly built buildings have the same number of units and per-unit level of consumption as similar existing buildings that have been recently built since 1990. This approach implicitly assumes that these new multifamily units adopt the current standards in water-efficient plumbing fixtures. The forecast incorporates employment growth of approximately 5,100 jobs per year, split across five different land-use types[8]. The forecast assumes that new commercial and industrial accounts have the same water use patterns as similarly sized existing firms with the same land-use category.

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[7] Specifically, we considered a "hot and dry" scenario, in which temperatures increase by 1.7 degrees Celsius and precipitation declines by 8.3% in 2045 relative to relative to 2020, and a "wet and slower warming" scenario where average temperatures increases by only 0.5 degrees Celsius and precipitation increases by 8.3% in 2045 relative to 2020. These scenarios reflect the expected range in climate trends, but do not reflect the expected range of year-to-year weather fluctuations.

[8] Employment forecasts and the five different types of land-use categories come from the Plan Bay Area produced by the Association of Bay Area Governments. The five different types of land-use are: Office/Professional; Health/Education/Recreation; Manufacturing/Wholesale; Retail/Restaurants; and Other.

TABLE 2: FORECAST ASSUMPTIONS – HOUSING UNIT AND EMPLOYMENT GROWTH

		FY2019-20 (Actual)	FY2019-20 (Forecast)	FY2024-25	FY2029-30	FY2034-35	FY2039-40	FY2044-45
No. Housing Units	Single-Family Residential	124,186	124,186	124,186	124,186	124,186	124,186	124,186
	Multi-Family Residential	275,127	275,127	300,932	326,737	352,542	378,347	404,152
	Total	399,313	399,313	425,118	450,923	476,728	502,533	528,338
No. Employees	Office/Professional	304,250	304,250	321,496	338,741	349,153	369,063	388,973
	Health/Education/Recreation	225,061	225,061	232,894	240,727	244,797	249,917	255,037
	Manufacturing/Wholesale	32,763	32,763	31,404	30,045	27,774	25,532	23,290
	Retail	50,541	50,541	52,208	53,875	54,979	56,479	57,979
	Other	160,952	160,952	164,819	168,686	169,471	170,885	172,299
	Total	773,567	773,567	802,821	832,074	846,174	871,876	897,578

TABLE 3: FORECAST ASSUMPTIONS - COVARIATES

	FY2019-20 (Actual)	FY2019-20 (Forecast)	FY2024-25	FY2029-30	FY2034-35	FY2039-40	FY2044-45
Average Real Marginal Rate (2020 Dollars / CCF)	9.2	9.2	12.1	13.6	14.0	14.0	14.0
Monthly Average Temperature (°C)	14.9	15.3	15.5	15.8	16.0	16.2	16.4
Monthly Average Precipitation (mm)	27.3	49.9	49.9	49.9	49.9	49.9	49.9
COVID-19	34%	0%	0%	0%	0%	0%	0%
Drought	0%	0%	0%	0%	0%	0%	0%

2. Econometric Projections

The econometric model that we use in the single-family and multi-family sectors is estimated on a per-unit basis, and our forecasts are also on a per-unit basis. Characteristics and fixed-effects for existing accounts are estimated from our data. For new multi-family residential and commercial and industrial accounts, we simulate firm fixed-effects. Then based on these individual fixed effects we estimate individual level demand using the following equation:

$$\widehat{q_{\imath t}} = e^{\ln(rate_t)\beta^{rate}+\ln(temp_{it})\beta^{\widehat{temp}}+\ln(ppt_{it})\widehat{\beta^{ppt}}+\gamma^{\widehat{COVID}}+\gamma^{\widehat{drght}}+\widehat{\gamma_\imath}}$$

Once we have calculated individual-level demand for each account, we calculate total demand by aggregating each of the individual estimates in our data:

$$\widehat{Q_t}^{Raw} = \sum_i \widehat{q_{\imath t}}$$

3. Add Water Conservation Estimates and Other Demands back into Forecast

The final step of the forecasting process is to subtract the estimated savings from active conservation programs and non-potable / onsite reuse programs based on SFPUC’s water conservation model and the additional demand from other sectors not covered in our model, specifically residential and non-residential fire accounts, docks and ship accounts, builder/contractors accounts back into our model to calculate total consumption in each sector. The forecasts for these accounts are outside of our model and were developed in consultation with SFPUC. Note that this memo does not address other sectors of water use, including losses, irrigation accounts, municipal accounts and suburban retail accounts.

$$\widehat{Q_t}^{Final} = \widehat{Q_t}^{Raw} - Q^{Conservation} + Q^{Other}$$

II. Single-Family Residential Forecast

A. Model Estimates

Table 4 summarizes the estimates of the demand model for the single-family residential sector. The model has good fit to the data due to account-level fixed effects that adjust for the average level of water use of every household. Specifically, the model has an R-squared of 0.72, implying that our estimate explains 72% of the total variation in demand.

Across all units in the sample, we estimate a price-elasticity of demand of -0.14. This elasticity implies that a 10% increase in rates will lead to a 1.4% reduction in demand. This estimate is statistically significant and has a confidence interval from -0.26 to -0.02. Note that SFPUC charges two tiers of variable rates and a fixed rate. The demand elasticity estimate is with respect to the two-tiers of rates variable rates but not the fixed rate. We estimate an elasticity of demand with respect to temperature of 0.13 and with respect to precipitation of -0.008. This estimate implies that a 10% increase in average temperature will lead to a 1.3% increase in demand, and that a 10% increase in precipitation will lead to a 0.08% decrease in demand. These estimates are also both statistically significant.

We estimate that the 2014-15 drought caused a 9% decline in demand for residential water use and that the COVID-19 pandemic caused a 12% increase in demand for residential water use.

TABLE 4: MODEL ESTIMATES – SINGLE-FAMILY RESIDENTIAL SECTOR

	Coefficient	95% Confidence Interval	Change in Consumption from 10% Predictor Change
log(Marginal Rates)	-0.14	[-0.26, -0.02]	-1.4%
log(Temperature)	0.13	[0.08, 0.18]	1.3%
log(Precipitation)	-0.008	[-0.01, -0.005]	-0.08%
			Change in Consumption from Predictor Event
COVID-19 (Starting 3/20)	0.09	[0.08, 0.10]	9.3%
Drought (Starting 4/14)	-0.13	[-0.21, -0.06]	-12.4%
Account Fixed-Effects	Yes		
R-squared	0.72		

B. Demand Forecast

Table 5: Demand Forecast - Single-Family Residential Sector summarizes our demand forecast for the single-family residential sector. Between today and FY2044-45, SFPUC does not forecast any growth in the existing stock of 124,186 single-family residential units in San Francisco. The forecast is calibrated to match total family single-family residential consumption in FY2019-20, which was 14.45 MGD or 116.4 gal/day for each unit. However, when we adjust prediction to remove the estimated impacts of COVID-19 and the relatively hot and dry weather in that year, we find that demand would have been slightly lower had 2019-20 been a `normal` year, with total consumption of 14.32 MGD or 115.3 gal/unit each day. Due to increasing rates and average temperatures, per-unit demand is forecast to decrease from 14.32 MGD or 115.3 gal/day per unit in FY2019-20 to 13.65 MGD or a daily 109.9 gal/unit in FY2044-45[9]. SFPUC's conservation model forecasts that active SFPUC conservation programs will lead to an estimated reduction in the total demand for water of 0.22 MGD or 0.9 gal/unit daily by 2045. After accounting for these conservation savings, our total demand is forecast to decrease to 13.54 MGD or 109.1 gal/unit daily in FY2044-45.

---

[9] We also forecast demand under two alternative climate scenarios: in the "hot and dry" scenario, we estimate unadjusted baseline demand per-unit of 110.3 gal/unit in 2045. In the "wet and slower warming" scenario, we estimate unadjusted baseline demand per-unit of 109.8 gal/unit in 2045.

TABLE 5: DEMAND FORECAST - SINGLE-FAMILY RESIDENTIAL SECTOR

	FY2019-20 (Actual)	FY2019-20 (Forecast)	FY2024-25	FY2029-30	FY2034-35	FY2039-40	FY2044-45
Number of Units	124,186	124,186	124,186	124,186	124,186	124,186	124,186
Residents per Unit	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Avg. Consumption per Capita (gal / day)							
Baseline Demand per Unit	50.6	50.1	48.4	47.7	47.6	47.7	47.8
Conservation - Active	-	-	-0.5	-0.6	-0.6	-0.5	-0.4
Demand per Capita	50.6	50.1	47.9	47.1	47.0	47.2	47.4
Avg. Consumption per Unit (gal / day)							
Baseline Demand per Unit	116.4	115.3	111.4	109.8	109.5	109.7	109.9
Conservation - Active	-	-	-1.2	-1.4	-1.4	-1.1	-0.9
Demand per Unit	116.4	115.3	110.1	108.3	108.2	108.7	109.1
Total Consumption (MGD)							
Baseline Demand	14.45	14.32	13.83	13.63	13.60	13.63	13.65
Conservation - Active	-	-	-0.15	-0.18	-0.17	-0.13	-0.11
Total Demand	14.45	14.32	13.68	13.45	13.43	13.49	13.54

III. Multiple-Family Residential Demand Forecast

A. Model Estimates

Table 6 summarizes the estimates of the demand model for the multiple-family residential sector. Note that forecasts are made on a per-unit rather than per-account basis, this distinction is important in the multiple-family rsidential sector, where many accounts serve multiple units. The model has good fit to the data due with an R-squared of 0.75, implying that our estimate explains 75% of the total variation in demand.

Across all units in the sample, we estimate a price-elasticity of demand of -0.2. This elasticity implies that a 10% increase in rates will lead to a 2.0% reduction in demand. This estimate is statistically significant and has a confidence interval from -0.30 to -0.10. Note that SFPUC charges two tiers of variable rates and a fixed rate. The demand elasticity estimate is with respect to the two-tiers of rates variable rates but not the fixed rate. We estimate an elasticity of demand with respect to temperature of 0.09 and with respect to precipitation of -0.002. This estimate implies that a 10% increase in average temperature will lead to a 0.9% increase in demand, and that a 10% increase in precipitation will lead to a 0.02% decrease in demand.

We find that drought caused a decline in water use of 7.4% and that the COVID-19 pandemic caused an increase in water use of 5.8%.

TABLE 6: MODEL ESTIMATES - MULTIPLE-FAMILY RESIDENTIAL SECTOR

	Coefficient	95% Confidence Interval	Change in Consumption from 10% Predictor Change
log(Marginal Price)	-0.20	[-0.30, -0.10]	-2.0%
log(Temperature)	0.09	[0.06, 0.12]	0.9%
log(Precipitation)	-0.002	[-0.004, -0.001]	0.0%
			Change in Consumption from Predictor Event
COVID-19 (Starting 3/20)	0.06	[0.05, 0.07]	5.8%
Drought (Starting 4/14)	-0.08	[-0.13, -0.02]	-7.4%
Account Fixed-Effects	Yes		
R-squared	0.75		

B. Demand Forecast

Table 7 summarizes the multi-family residential demand forecast. The San Francisco Planning Department forecasts significant growth in the stock of multi-family residential units in San Francisco at a rate of approximately 5,100 units per year from 275,000 units in FY2019-20 to 404,000 units in FY2044-45.

The forecast is calibrated to match total multi-family residential consumption in FY2019-20, which was 22.9 MGD or 83.3 gal/day for each unit.[10] However, when we adjust our estimate to consider a typical year, removing the impacts of COVID-19 and the relatively hot and dry weather in that year, we find that demand would have been slightly lower, a total of 22.5 MGD or a daily 81.7 gal/unit. Increasing rates will push consumption down, and increasing average temperatures which will drive consumption up. Consumption will also be affected by the composition of dwellings, with newly build units on average consuming more water than older ones. On net, per-unit demand is forecast to increase from 81.7 gal/day per unit in 2019-20 to 84.1 gal/unit primarily driven by higher per-unit consumption in new

---

[10] This total demand number includes combination residential and fire accounts.

buildings[11]. Due to the significant growth in the number of units, total consumption is forecast to increase from 22.5 MGD to 34.0 MGD. SFPUC's conservation model also forecasts that there will be a reduction in water use as a result of active SFPUC conservation programs, and the implementation of onsite reuse systems. These conservation programs are expected to account for a total of 1.0 MGD or 2.4 gal/unit daily by FY2044-45. After accounting for conservation savings, total demand is forecast to be 33.0 MGD or 81.7 gal/unit daily in FY2044-45.

TABLE 7: DEMAND FORECAST – MULTIPLE-FAMILY RESIDENTIAL SECTOR

	FY2019-20 (Actual)	FY2019-20 (Forecast)	FY2024-25	FY2029-30	FY2034-35	FY2039-40	FY2044-45
Number of Units	275,127	275,127	300,932	326,737	352,542	378,347	404,152
Residents per Unit	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Avg. Consumption per Capita (gal / day)							
Unadjusted Baseline Demand	36.2	35.5	34.7	34.8	35.3	36.0	36.6
Conservation: *Active*	-	-	-0.2	-0.3	-0.2	-0.1	-0.1
Non-Potable / Onsite Reuse	-0.1	-0.1	-0.3	-0.5	-0.8	-1.0	-1.0
Demand per Capita	36.1	35.4	34.2	34.0	34.3	34.8	35.5
Avg. Consumption per Unit (gal / day)							
Unadjusted Baseline Demand	83.3	81.7	79.8	80.0	81.3	82.8	84.1
Conservation: *Active*	-	-	-0.5	-0.6	-0.5	-0.3	-0.1
Non-Potable / Onsite Reuse	-0.3	-0.3	-0.7	-1.1	-1.8	-2.4	-2.3
Demand per Unit	83.0	81.4	78.7	78.3	79.0	80.1	81.7
Total Consumption (MGD)							
Unadjusted Baseline Demand	22.9	22.5	24.0	26.1	28.7	31.3	34.0
Conservation: *Active*	-	-	-0.1	-0.2	-0.2	-0.1	-0.1
Non-Potable / Onsite Reuse	-0.1	-0.1	-0.2	-0.4	-0.6	-0.9	-0.9
Total Demand	22.8	22.4	23.7	25.6	27.8	30.3	33.0

IV. Commercial and Industrial Demand Forecast

A. Model Estimates

Table 8 summarizes the estimates of the demand model for the commercial and industrial sector. Note that we estimate a model on a per-unit account, but we present our results on a per-employee basis, as this is the input data into our forecast model. Due to the substantial heterogeneity in the commercial and industrial sectors, we estimate a model that allows for different types of land-use to be differentially responsive to changes in rates and COVID-19. Specifically, we estimate different

---

[11] We also forecast demand under two alternative climate scenarios: in the "hot and dry" scenario, we estimate unadjusted baseline demand per-unit of 84.0 gal/unit in 2045. In the "wet and slower warming" scenario, we estimate unadjusted baseline demand per-unit of 84.3 gal/unit in 2045.

coefficients for different types of land-use. The model has good fit to the data due with an R-squared of 0.88 implying that our estimate explains 88% of the total variation in demand.

We estimate five price elasticities, which vary from -0.14 in the manufacturing/wholesale sector to -0.3 in the health/education/retail sector. These elasticities imply that a 10% increase in rates will lead to a reduction in demand of between 1.4 and 3.0 percent. We estimate that these demand elasticities are statistically significant in the Office / Professional, Health/Education/Recreation, and Other sectors, but not in the Retail and Manufacturing/Wholesale sectors[12]. We estimate an elasticity of demand with respect to temperature of 0.14 and with respect to precipitation of -0.002. This estimate implies that a 10% increase in average temperature will lead to a 1.4% increase in demand, and that a 10% increase in precipitation will lead to a 0.02% decrease in demand.

We estimate that the COVID-19 pandemic caused a substantial reduction in demand across all sectors of commercial and industrial accounts. This reduction in demand was smallest in the Manufacturing/Wholesale and Retail/Restaurant sectors at -39.6% and -41.9% respectively, and it was largest in the Office/Professional, Health/Education/Recreation, and Other sectors at -53.6%, -49.7% and -56.5% respectively. We do not find that drought caused a statistically significant change in commercial and industrial consumption.

TABLE 8: MODEL ESTIMATES- COMMERCIAL AND INDUSTRIAL SECTOR

	Coefficient	**95% Confidence Interval**	**Change in Consumption from 10% Predictor Change**
log(Marginal Price) : Office/Professional	-0.19	[-0.33, -0.05]	-1.9%
log(Marginal Price) : Health/Education/Recreation	-0.30	[-0.42, -0.17]	-3.0%
log(Marginal Price) : Manufacturing/Wholesale	-0.14	[-0.32, 0.04]	-1.4%
log(Marginal Price) : Retail	-0.19	[-0.50, 0.12]	-1.9%
log(Marginal Price) : Other	-0.22	[-0.35, -0.09]	-2.2%
log(Temperature)	0.14	[0.09, 0.18]	1.4%
log(Precipitation)	-0.002	[-0.003, -0.001]	0.0%
			Change in Consumption from Predictor Event
COVID-19 (Starting 3/20) : Office/Professional	-0.77	[-0.83, -0.71]	-53.6%
COVID-19 (Starting 3/20) : Health/Education/Recreation	-0.69	[-0.71, -0.66]	-49.7%
COVID-19 (Starting 3/20) : Manufacturing/Wholesale	-0.50	[-0.53, -0.48]	-39.6%
COVID-19 (Starting 3/20) : Retail	-0.54	[-0.61, -0.48]	-41.9%
COVID-19 (Starting 3/20) : Other	-0.83	[-0.86, -0.80]	-56.5%
Drought (Starting 4/14)	0.004	[-0.05, 0.05]	0.4%
Account Fixed-Effects	Yes		
R-squared	0.88		

---

[12] Our estimates are deemed be statistically significant if the estimated 95% confidence interval does not include zero. If the estimated 95% confidence interval does include zero, the estimates are considered to not be statistically significant. Note that to obtain the best fitting model, we include all variables in our forecasts regardless of whether or not they are statistically significant.

B. Demand Forecast

Table 9 summarizes the commercial and industrial demand forecast. The San Francisco Planning Department forecasts that the City will experience significant employment growth, of approximately 5,100 jobs per year, from 774,000 jobs in FY2019-20 to 898,000 jobs in FY2044-45.

The forecast is calibrated to match total multiple-family residential consumption in FY2019-20, which was 14.7 MGD or 19.0 gal/day for each employee. However, when we adjust our estimate to consider a typical year, removing the impacts of COVID-19 and the relatively hot and dry weather in that year, we find that demand would have been significantly higher, a total of 17.8 MGD or a daily 23.0 gal/employee. Per-employee demand is forecast to decrease from 23.0 gal/day per employee in 2019-20 to 20.5 gal/employee, driven primarily by increasing rates, and slightly offset by increasing temperatures[13]. However due to the significant growth in the number of employees, total consumption is forecast to increase from 17.8 MGD to 18.4 MGD. SFPUC's conservation model also forecasts that there will be a significant reduction in water use as a result of active SFPUC conservation programs and adoption of non-potable water and onsite reuse programs. These conservation programs are expected to reduce total water-use by 0.6 MGD or 0.7 gal/employee daily by FY2044-45. After accounting for conservation savings, total demand is forecast to be approximately flat, finishing at 17.8 MGD gal/employee daily in FY2044-45.

TABLE 9: DEMAND FORECAST - COMMERCIAL AND INDUSTRIAL SECTOR

	FY2019-20 (Actual)	**FY2019-20 (Forecast)**	**FY2024-25**	**FY2029-30**	**FY2034-35**	**FY2039-40**	**FY2044-45**
Number of Employees	773,567	773,567	802,821	832,074	846,174	871,876	897,578
Avg. Consumption per Employee (gal / day)							
Unadjusted Baseline Demand	19.0	23.0	21.5	20.8	20.7	20.6	20.5
Conservation: *Active*	0.0	0.0	-0.4	-0.4	-0.4	-0.3	-0.3
Non-Potable / Onsite Reuse	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.4
Total Demand	19.0	23.0	21.0	20.3	20.0	19.8	19.8
Total Consumption (MGD)							
Unadjusted Baseline Demand	14.7	17.8	17.3	17.3	17.5	17.9	18.4
Conservation: *Active*	0.0	0.0	-0.3	-0.3	-0.3	-0.3	-0.2
Non-Potable / Onsite Reuse	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.4
Total Demand	14.7	17.8	16.9	16.9	16.9	17.3	17.8

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[13] We also forecast demand under two alternative climate scenarios: in the "hot and dry" scenario, we estimate unadjusted baseline demand per-unit of 20.6 gal/unit in 2045. In the "wet and slower warming" scenario, we estimate unadjusted baseline demand per-unit of 20.5 gal/unit in 2045.

APPENDIX F

In-City Retail Water Audit Worksheet (Draft)

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits
for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person: Chris Hewes
Email Address: chewes@sfwater.org
Telephone | Ext.: 4153213422 |
Name of City / Utility: San Francisco Public Utilities Commission
City/Town/Municipality: San Francisco
State / Province: California (CA)
Country: USA
Year: 2020 | Financial Year
Start Date: 07/2019 Enter MM/YYYY numeric format
End Date: 06/2020 Enter MM/YYYY numeric format
Audit Preparation Date: 12/1/2020
Volume Reporting Units: Million gallons (US)
PWSID / Other ID: 3810011

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

☐	Value can be entered by user
🟨	Value calculated based on input data
🟪	These cells contain recommended default values

Use of Option (Radio) Buttons:

Pcnt:			Value:
0.25%	●	○	

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

? Click to access definition
\+ Click to add a comment

Water Audit Report for: San Francisco Public Utilities Commission (3810011)
Reporting Year: 2020 7/2019 - 6/2020

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED

							Pcnt:		Value:	
Volume from own sources:	+ ?	10	23,139.650	MG/Yr	+ ?	8		○ ●	-49.147	MG/Yr
Water imported:	+ ?	n/a	0.000	MG/Yr	+ ?			● ○		MG/Yr
Water exported:	+ ?	n/a	0.000	MG/Yr	+ ?			● ○		MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: **23,188.797** MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:		Value:	
Billed metered:	+ ?	9	20,229.578	MG/Yr				
Billed unmetered:	+ ?	n/a	0	MG/Yr				
Unbilled metered:	+ ?	10	260.321	MG/Yr				
Unbilled unmetered:	+ ?	8	70.753	MG/Yr		○ ●	70.753	MG/Yr

Use buttons to select percentage of water supplied
OR
value

AUTHORIZED CONSUMPTION: ? **20,560.652** MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) **2,628.145** MG/Yr

Apparent Losses

					Pcnt:		Value:	
Unauthorized consumption:	+ ?	6	28.986	MG/Yr		○ ●	28.986	MG/Yr
Customer metering inaccuracies:	+ ?	7	391.905	MG/Yr		○ ●	391.905	MG/Yr
Systematic data handling errors:	+ ?	9	12.806	MG/Yr		○ ●	12.806	MG/Yr

Apparent Losses: ? **433.698** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ? **2,194.447** MG/Yr

WATER LOSSES: **2,628.145** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: ? **2,959.219** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+ ?	9	1,275.2	miles
Number of active AND inactive service connections:	+ ?	9	179,156	
Service connection density:	?		140	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: + ? (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: + ? 7 76.1 psi

COST DATA

Total annual cost of operating water system:	+ ?	10	$379,126,174	$/Year
Customer retail unit cost (applied to Apparent Losses):	+ ?	10	$21.13	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	+ ?	5	$294.10	$/Million gallons ☐Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 89 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Variable production cost (applied to Real Losses)
2: Customer metering inaccuracies
3: Unauthorized consumption

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: San Francisco Public Utilities Commission (3810011)
Reporting Year: 2020 | 7/2019 - 6/2020

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 89 out of 100 *****

System Attributes:

Apparent Losses:	433.698	MG/Yr
+ Real Losses:	2,194.447	MG/Yr
= **Water Losses:**	**2,628.145**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	938.07	MG/Yr
Annual cost of Apparent Losses:	$12,250,527	
Annual cost of Real Losses:	$645,387	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	12.8%	
	Non-revenue water as percent by cost of operating system:	3.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.63	gallons/connection/day
	Real Losses per service connection per day:	33.56	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.44	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	2,194.45	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.34	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
User Comments

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	
Billed unmetered:	
Unbilled metered:	

Audit Item	Comment
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	San Francisco Public Utilities Commission (3810011)	
Reporting Year:	2020	7/2019 - 6/2020
Data Validity Score:	89	

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(Adjusted for known errors)
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0.000</td></tr>
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433.698</td><td>Unauthorized Consumption
28.986</td></tr>
<tr><td>Customer Metering Inaccuracies
391.905</td></tr>
<tr><td>Systematic Data Handling Errors
12.806</td></tr>
<tr><td rowspan="3">Water Imported
0.000</td><td rowspan="3">Real Losses
2,194.447</td><td>Leakage on Transmission and/or Distribution Mains
Not broken down</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks
Not broken down</td></tr>
<tr><td>Leakage on Service Connections
Not broken down</td></tr>
</table>

AWWA Free Water Audit Software: Dashboard

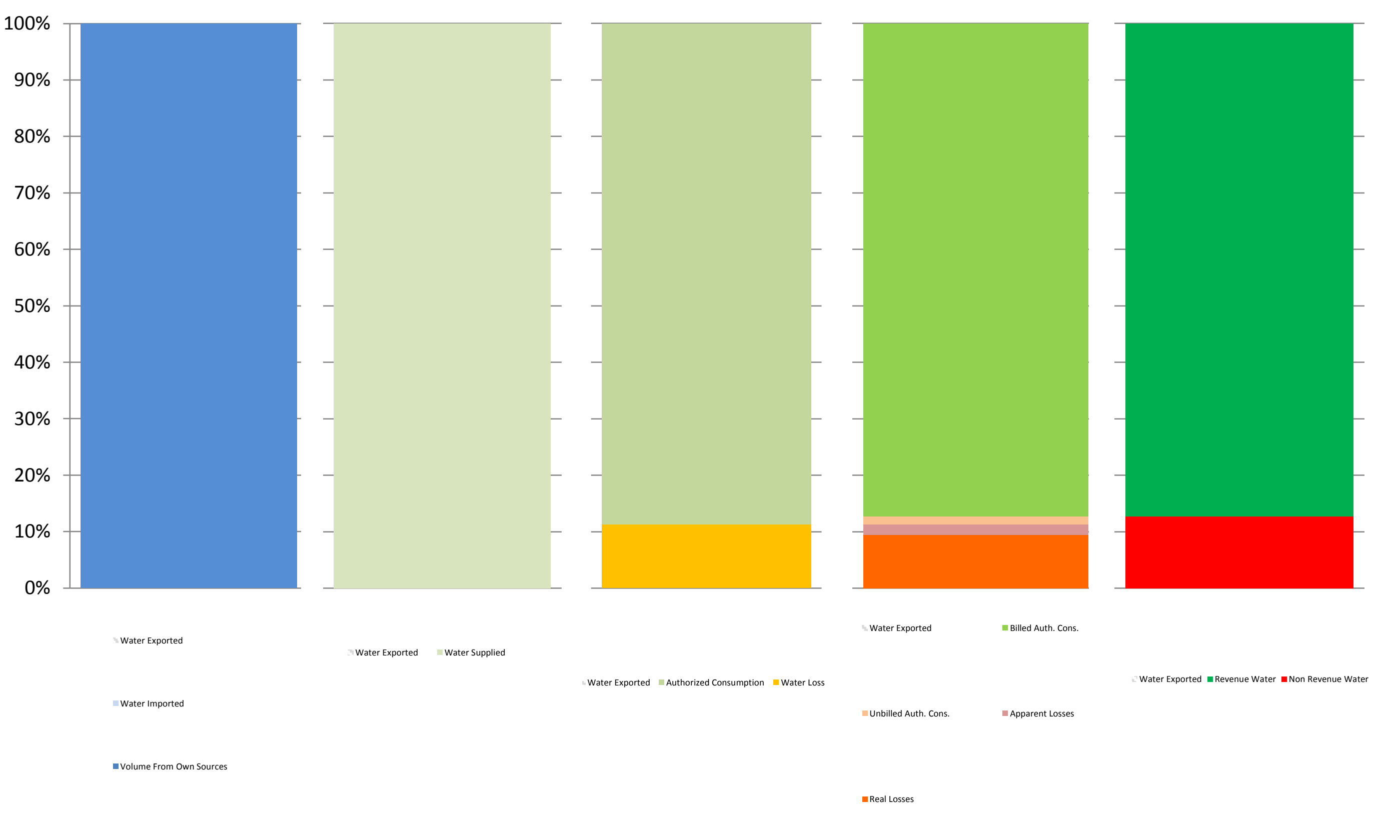
WAS v5.0

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

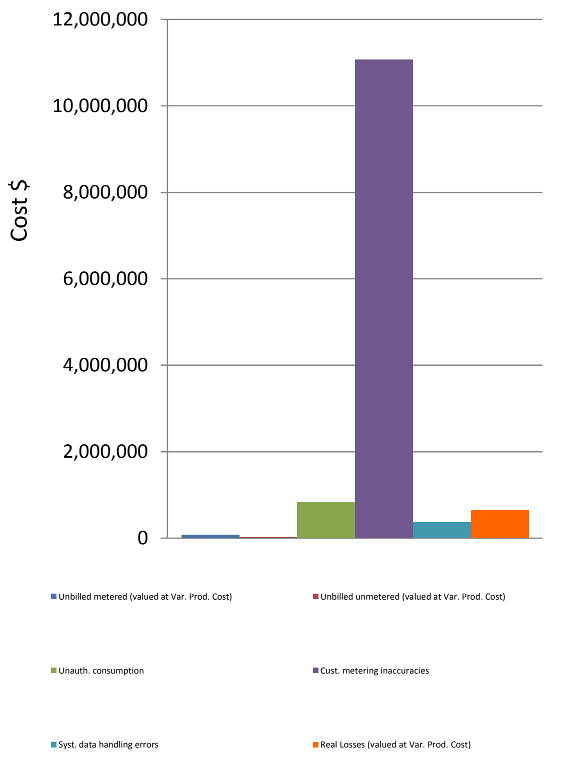
Water Audit Report for:	San Francisco Public Utilities Commission (3810011)	
Reporting Year:	2020	7/2019 - 6/2020
Data Validity Score:	89	

○ Show me the VOLUME of Non-Revenue Water

● Show me the COST of Non-Revenue Water



Total Cost of NRW =$12,993,283



AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:	▨	to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:	▨	to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water Imported Volume" component: (*Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.*)	▨	to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water imported master meter and supply error adjustment:	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:	▨	to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: (*Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.*)	▨	to qualify for 2: Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	To qualify for 4: Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remainding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records eixst, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:	▨	to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:	▨	to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:	▨	Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, umetered consumption is usually a relatively small quatity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to quality for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:	▨	to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:	▨	Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:	▨	to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Number of active AND inactive service connections:		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does not include fire hydrant leads/lines connecting the hydrant to the water main**	to qualify for 2: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	to qualify for 4: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		to qualify for 6: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		to qualify for 8: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		to qualify for 10: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		to maintain 10: Continue with standardization and random field validation to improve knowledge of system.
Average length of customer service line:	Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									Either of two conditions can be met for a grading of 10: a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet . b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	to qualify for 4: Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		to qualify for 6: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		to qualify for 8: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		to qualify for 10: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		to maintain 10: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Average Operating Pressure" component:	▨	to qualify for 2: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4: Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		to qualify for 6: Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		to qualify for 8: Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		to qualify for 10: Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		to maintain 10: Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8: Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		to qualify for 2: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	to qualify for 4: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		to qualify for 8: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

AWWA Free Water Audit Software: Customer Service Line Diagrams

WAS v5.0

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

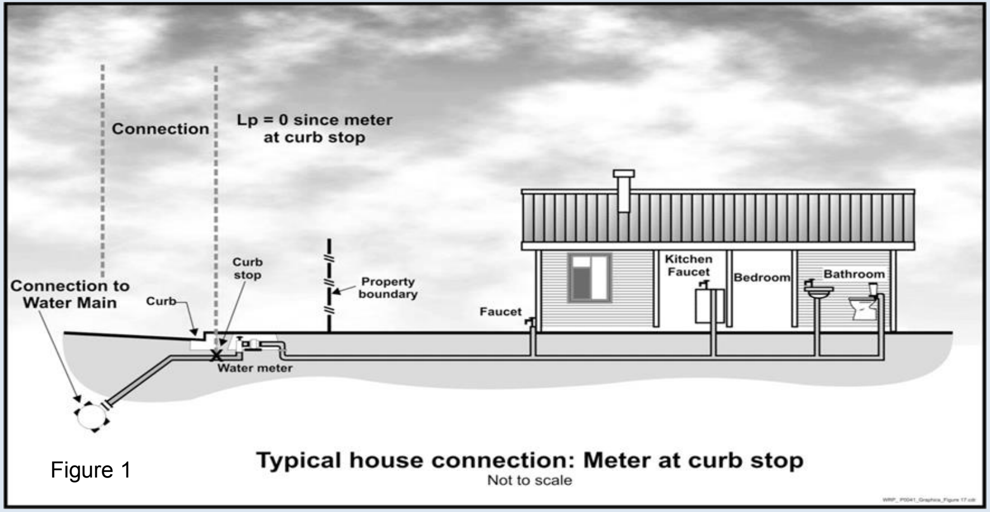


Figure 1

Typical house connection: Meter at curb stop
Not to scale

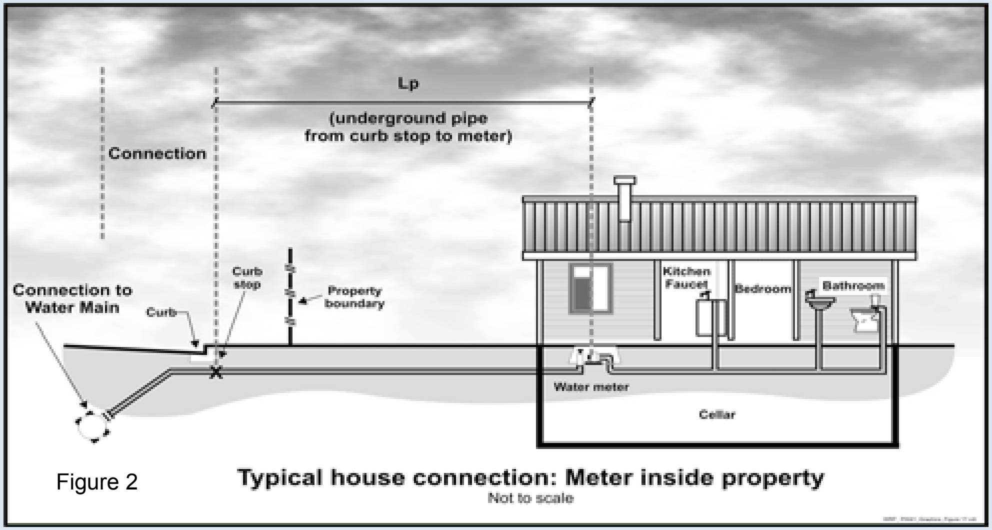


Figure 2

Typical house connection: Meter inside property
Not to scale

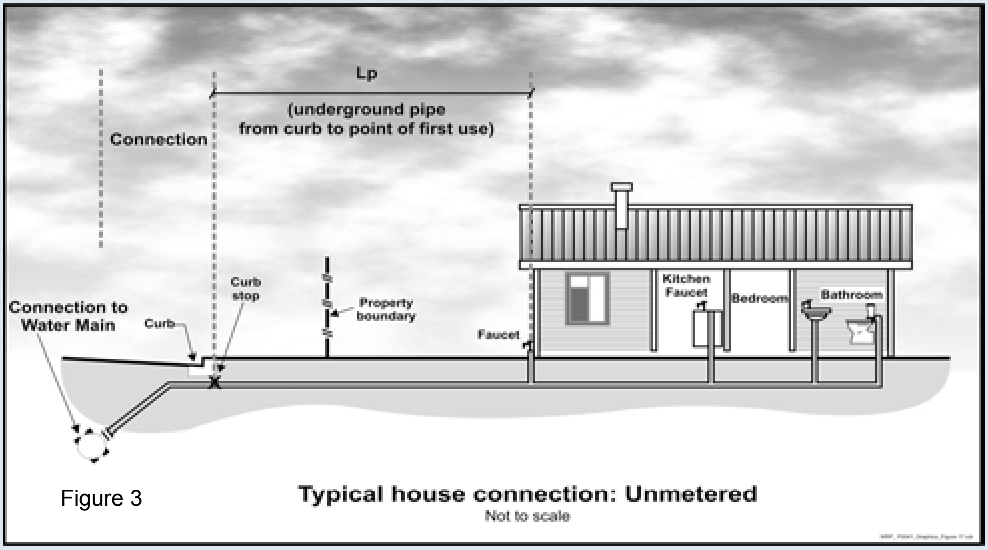


Figure 3

Typical house connection: Unmetered
Not to scale

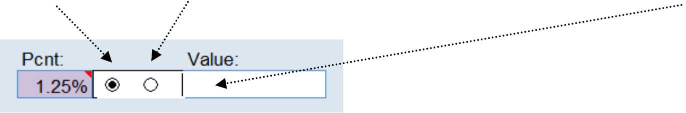
AWWA Free Water Audit Software:
Definitions

WAS v5.0

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
View Service Connection Diagram **Average length of customer service line** Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. <u>Data Transfer Errors</u> result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from <u>Data Analysis Errors</u> in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor <u>has</u> investigated the billing system and its controls, and <u>has</u> well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. <u>Note:</u> negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, <u>in gallons:</u> (Lm x 32) + Nc < 3000 or P <35psi <u>in litres:</u> (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is <u>deemed by utility policy</u> to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does <u>not</u> include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility <u>has</u> carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 Convert From… **Million Gallons (US)** = **Converts to…..** **3.06888329** **Acre-feet** (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right  **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (howe ver, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of <u>treated</u> drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0

Water Audit Report for: San Francisco Public Utilities Commission (3810011)
Reporting Year: 2020 7/2019 - 6/2020
Data Validity Score: 89

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

WAS v5.0

AWWA Free Water Audit Software:
Examples of Completed and Validated Audits

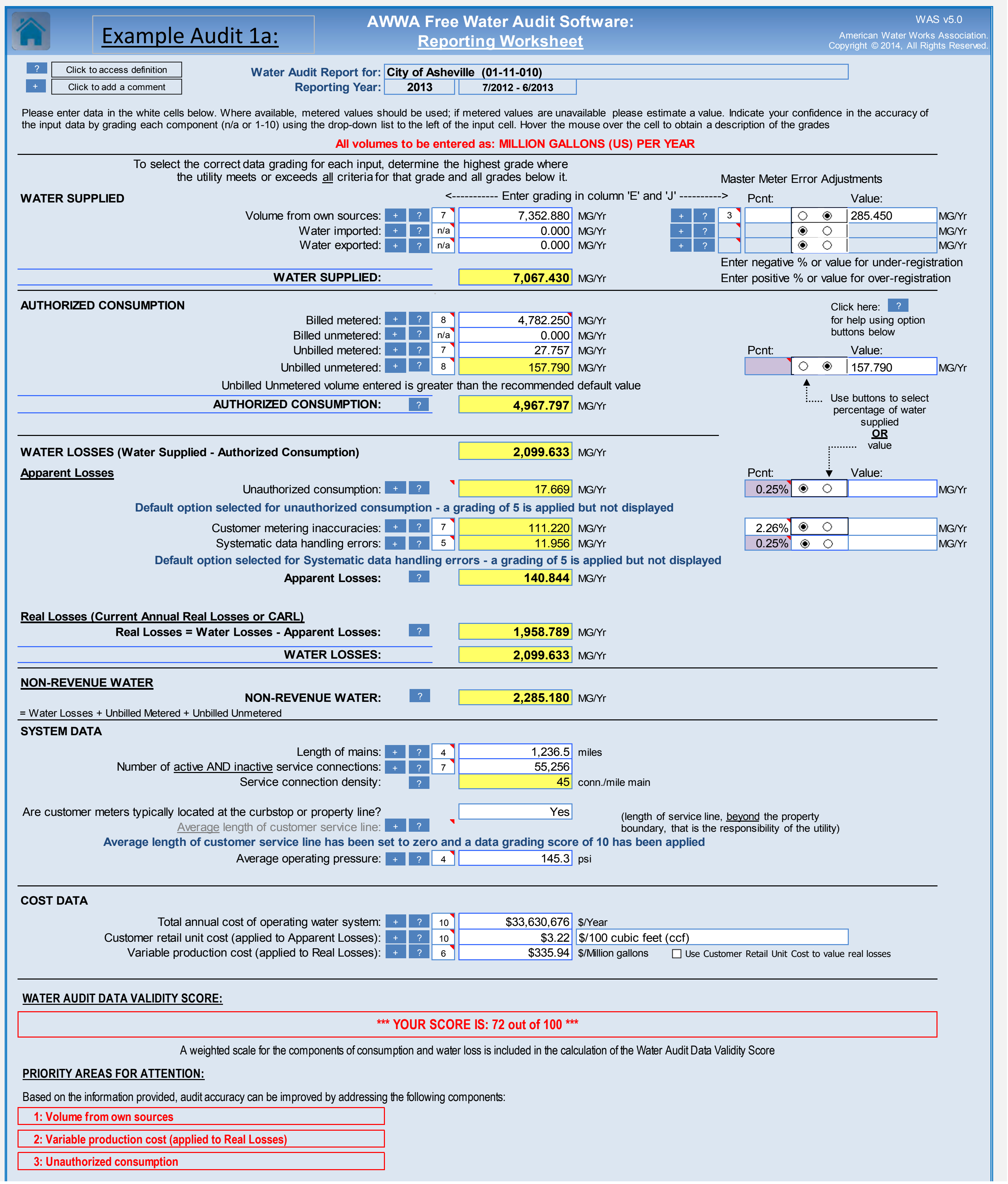
American Water Works Association.

Example 1a: Million Gallons:

Example 1b: Million Gallons: Performance Indicators

Example 2a: Megalitres: Reporting Worksheet

Example 2b: Megalitres: Reporting Worksheet



Example Audit 1a:

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

American Water Works Association.
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? Click to access definition
\+ Click to add a comment

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<----------- Enter grading in column 'E' and 'J' ---------->

	Grade	Value	Unit	Grade	Pcnt:		Value:	Unit
Volume from own sources:	7	7,352.880	MG/Yr	3		○ ●	285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr			● ○		MG/Yr
Water exported:	n/a	0.000	MG/Yr			● ○		MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 7,067.430 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value	Unit
Billed metered:	8	4,782.250	MG/Yr
Billed unmetered:	n/a	0.000	MG/Yr
Unbilled metered:	7	27.757	MG/Yr
Unbilled unmetered:	8	157.790	MG/Yr

Pcnt: Value: ○ ● 157.790 MG/Yr

Use buttons to select percentage of water supplied OR value

Unbilled Unmetered volume entered is greater than the recommended default value

AUTHORIZED CONSUMPTION: 4,967.797 MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 2,099.633 MG/Yr

Apparent Losses

Pcnt: Value:

Unauthorized consumption: 17.669 MG/Yr 0.25% ● ○ MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

	Grade	Value	Unit	Pcnt:		Value:	Unit
Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%	● ○		MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%	● ○		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 140.844 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 1,958.789 MG/Yr

WATER LOSSES: 2,099.633 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 2,285.180 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Unit
Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 4 145.3 psi

COST DATA

	Grade	Value	Unit
Total annual cost of operating water system:	10	$33,630,676	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	6	$335.94	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

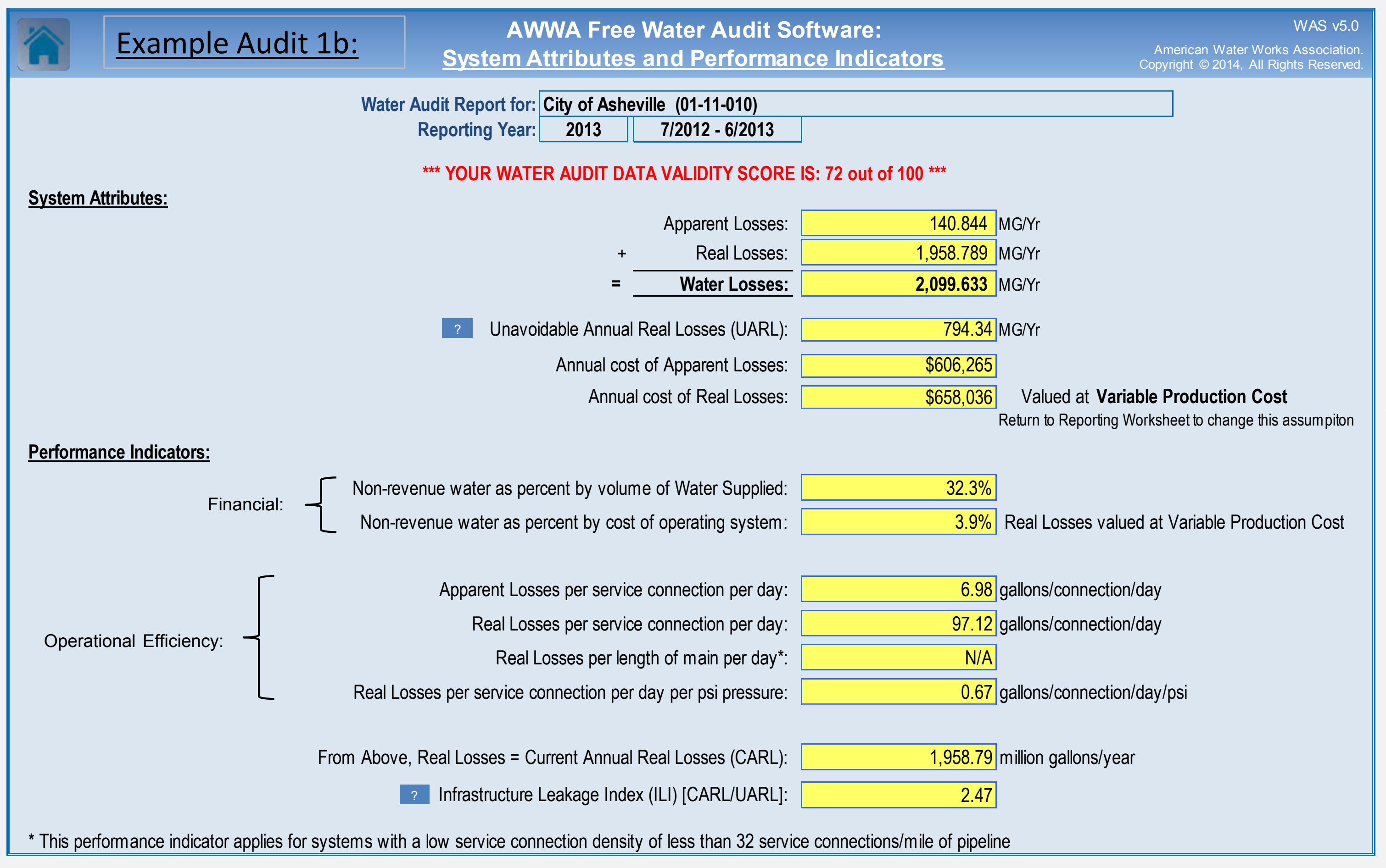
*** YOUR SCORE IS: 72 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption



Example Audit 1b:

AWWA Free Water Audit Software:

System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.
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Water Audit Report for: **City of Asheville (01-11-010)**

Reporting Year: **2013** **7/2012 - 6/2013**

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 *****

System Attributes:

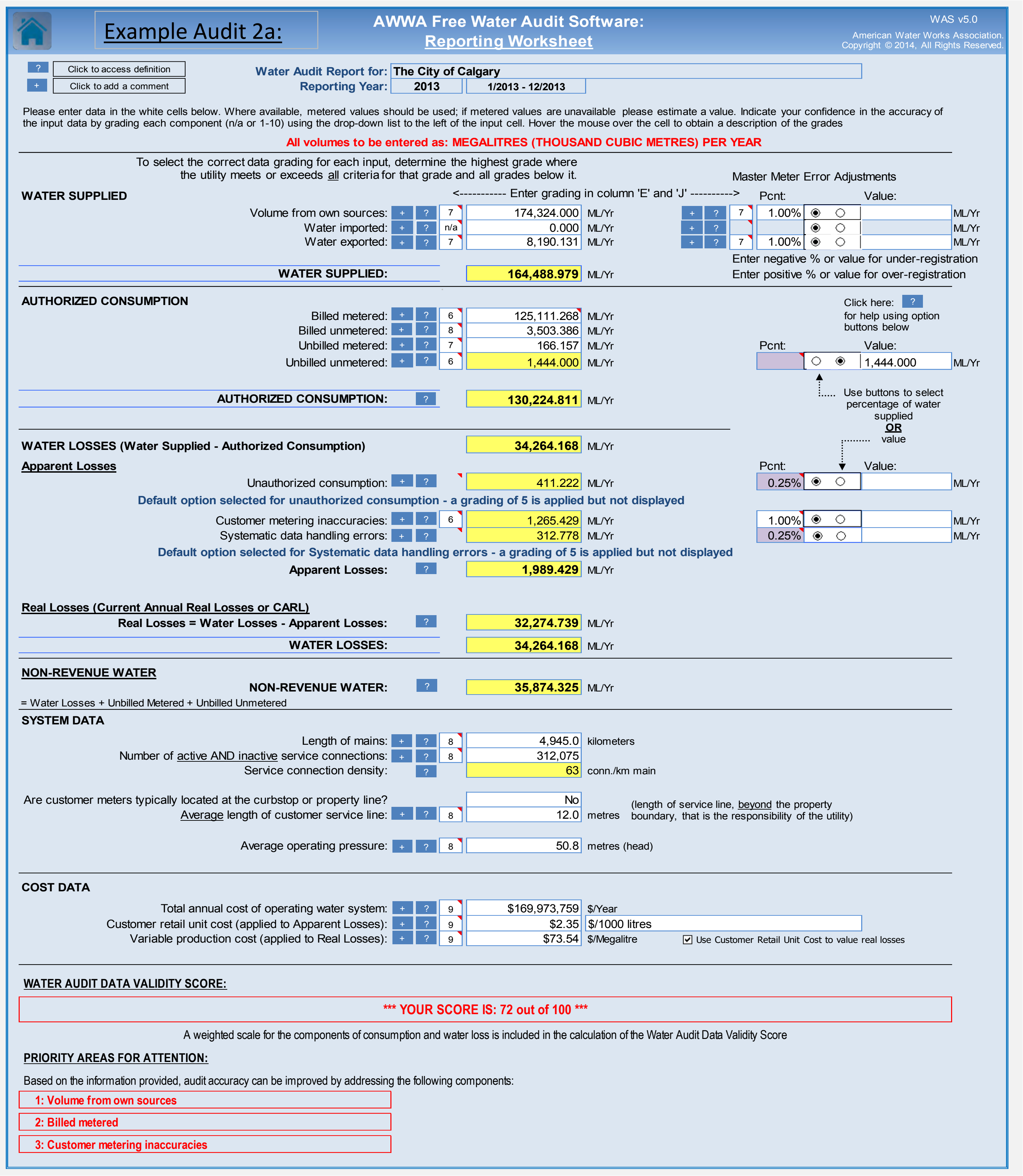
	Apparent Losses:	140.844	MG/Yr
+	Real Losses:	1,958.789	MG/Yr
=	**Water Losses:**	**2,099.633**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
	Annual cost of Apparent Losses:	$606,265	
	Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	32.3%	
	Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.98	gallons/connection/day
	Real Losses per service connection per day:	97.12	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline



Example Audit 2a:

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0
American Water Works Association.
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? Click to access definition
+ Click to add a comment

Water Audit Report for: **The City of Calgary**
Reporting Year: **2013** **1/2013 - 12/2013**

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<----------- Enter grading in column 'E' and 'J' ---------->

									Pcnt:			Value:	
Volume from own sources:	+	?	7	174,324.000	ML/Yr	+	?	7	1.00%	●	○		ML/Yr
Water imported:	+	?	n/a	0.000	ML/Yr	+	?			●	○		ML/Yr
Water exported:	+	?	7	8,190.131	ML/Yr	+	?	7	1.00%	●	○		ML/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: **164,488.979** ML/Yr

AUTHORIZED CONSUMPTION

Click here: ?
for help using option buttons below

						Pcnt:			Value:	
Billed metered:	+	?	6	125,111.268	ML/Yr					
Billed unmetered:	+	?	8	3,503.386	ML/Yr					
Unbilled metered:	+	?	7	166.157	ML/Yr					
Unbilled unmetered:	+	?	6	1,444.000	ML/Yr		○	●	1,444.000	ML/Yr

AUTHORIZED CONSUMPTION: ? **130,224.811** ML/Yr

Use buttons to select percentage of water supplied
OR
value

WATER LOSSES (Water Supplied - Authorized Consumption) **34,264.168** ML/Yr

Apparent Losses

						Pcnt:			Value:	
Unauthorized consumption:	+	?		411.222	ML/Yr	0.25%	●	○		ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	+	?	6	1,265.429	ML/Yr	1.00%	●	○		ML/Yr
Systematic data handling errors:	+	?		312.778	ML/Yr	0.25%	●	○		ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: ? **1,989.429** ML/Yr

Real Losses (Current Annual Real Losses or CARL)
Real Losses = Water Losses - Apparent Losses: ? **32,274.739** ML/Yr

WATER LOSSES: **34,264.168** ML/Yr

NON-REVENUE WATER
NON-REVENUE WATER: ? **35,874.325** ML/Yr
= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+	?	8	4,945.0	kilometers
Number of active AND inactive service connections:	+	?	8	312,075	
Service connection density:		?		63	conn./km main

Are customer meters typically located at the curbstop or property line? No
Average length of customer service line: + ? 8 12.0 metres (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average operating pressure: + ? 8 50.8 metres (head)

COST DATA

Total annual cost of operating water system:	+	?	9	$169,973,759	$/Year
Customer retail unit cost (applied to Apparent Losses):	+	?	9	$2.35	$/1000 litres
Variable production cost (applied to Real Losses):	+	?	9	$73.54	$/Megalitre

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

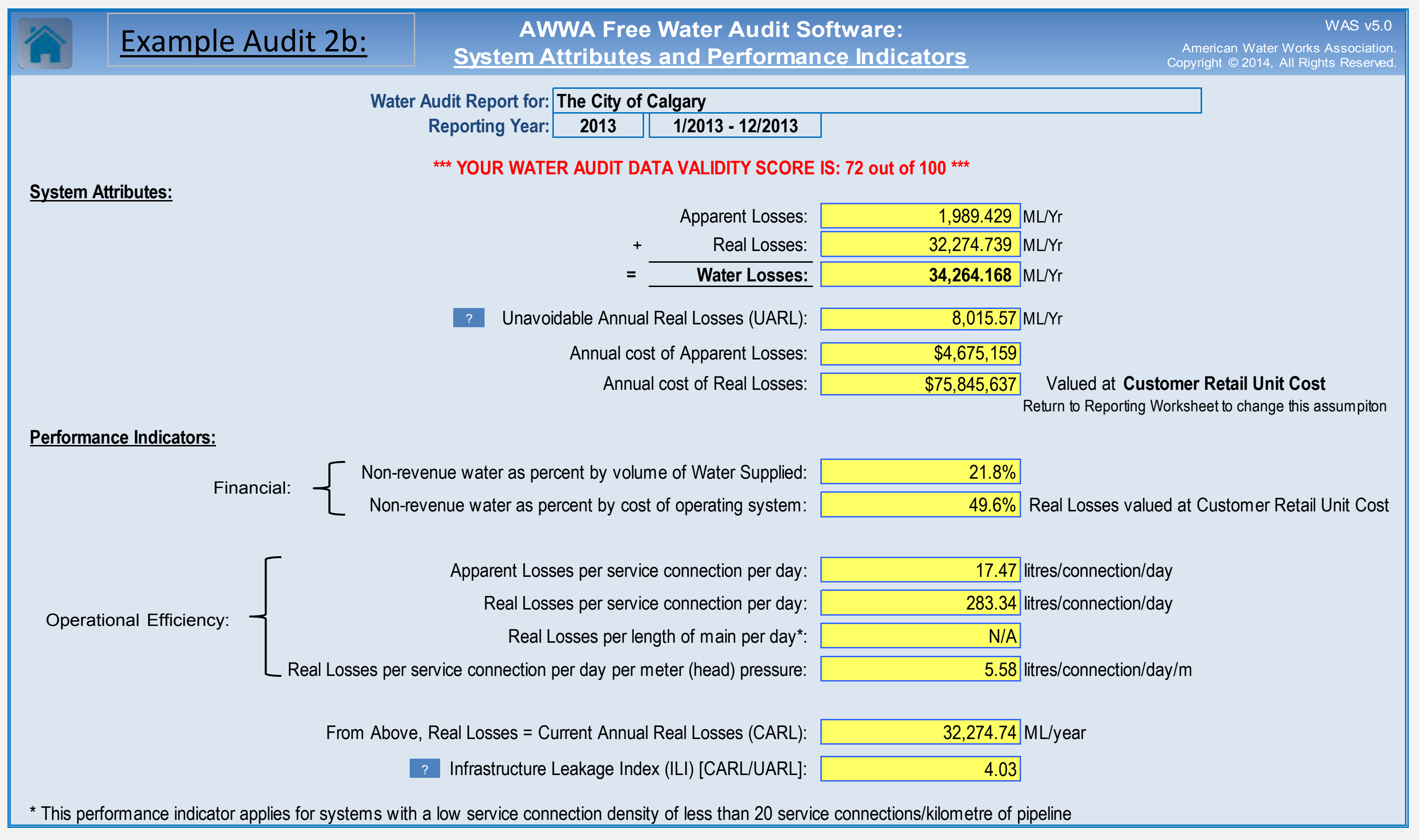
PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Billed metered

3: Customer metering inaccuracies



Example Audit 2b:

AWWA Free Water Audit Software:

System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.
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Water Audit Report for: **The City of Calgary**

Reporting Year: **2013** **1/2013 - 12/2013**

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 *****

System Attributes:

	Apparent Losses:	1,989.429	ML/Yr
+	Real Losses:	32,274.739	ML/Yr
=	**Water Losses:**	**34,264.168**	ML/Yr
?	Unavoidable Annual Real Losses (UARL):	8,015.57	ML/Yr
	Annual cost of Apparent Losses:	$4,675,159	
	Annual cost of Real Losses:	$75,845,637	Valued at **Customer Retail Unit Cost** Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	21.8%	
	Non-revenue water as percent by cost of operating system:	49.6%	Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:	17.47	litres/connection/day
	Real Losses per service connection per day:	283.34	litres/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per meter (head) pressure:	5.58	litres/connection/day/m
	From Above, Real Losses = Current Annual Real Losses (CARL):	32,274.74	ML/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.03	

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline

www.awwa.org

AWWA Free Water Audit Software: Acknowledgements

WAS v5.0

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or “top-down”, water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or “bottom-up”, water audit using the same water audit methodology.

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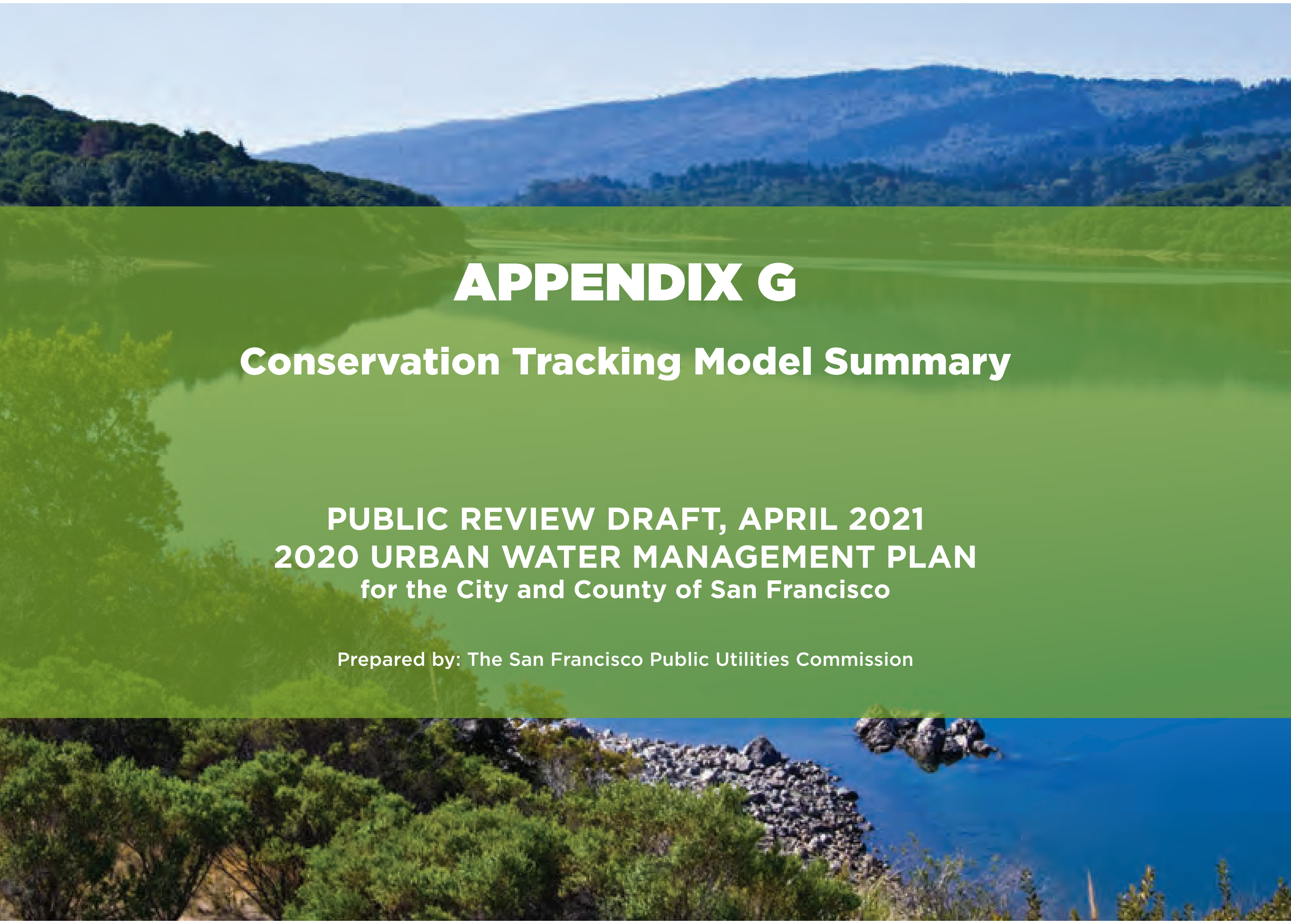
- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009
- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.



APPENDIX G

Conservation Tracking Model Summary

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

SFPUC Conservation Tracking Model

Water and Energy Savings Specifications for Conservation Program Measures

David Mitchell, M.Cubed

Last Updated: 03-08-2021

Overview

The SFPUC Conservation Tracking Model is a tool developed to track conservation program activity, water savings, and costs and benefits for SFPUC's retail service area conservation programs. The model is a customized version of the Alliance for Water Efficiency's (AWE) Water Conservation Tracking Tool, an Excel-based water conservation tracking model with more than four hundred registered water utility users throughout North America. In 2014, the SFPUC customized the AWE Conservation Tracking Tool for its retail service area and began using it to forecast water savings from conservation measures.

The purpose of this Water and Energy Savings Specifications for Conservation Program Measures Technical Memorandum is to document the assumptions and methodologies used to estimate water savings for every measure in the SFPUC's Conservation Tracking Model and key updates made over time. This document reflects all measures with modeled water savings included in the Conservation Tracking Model, including measures the SFPUC implements now or plans to in the next five years, implemented in the past, and ones SFPUC has evaluated and not implemented and may or may not do so in the future. It does not reflect conservation measures the SFPUC provides or provided in the past that don't have established or sufficient water-savings methodologies.

History of SFPUC Conservation Forecast Modelling

The SFPUC developed its first model in 2004 to forecast both in-City retail water demands and water savings from conservation measures. The SFPUC used estimated conservation water savings generated by this model to develop its 2004 and 2011 conservation plans. The SFPUC migrated from using this combined demand/forecast model in 2014, and started using a separate econometric demand model developed by Brattle Group to estimate retail demands and to the SFPUC Conservation Tracking Model to estimate water savings from conservation measures. In 2020, the SFPUC updated its econometric demand model for its retail service area for use in preparing its 2020 Urban Water Management Plan and for providing updated demand estimates for its 2020 Retail Conservation Plan.

Model Structure

The Conservation Tracking Model is an Excel-based model with an extensive Visual Basic backend. Using the model requires completing Model Setup, Program Specification, and Annual Activity data input tasks. Each data input task is contained on a separate worksheet in the model.

Model Setup consists of providing the model with the baseline forecasts of population, housing units, and water demand, as well as other basic system information the model uses to calculate the costs and benefits of conservation programs. The baseline water demand forecast comes from the Brattle Group econometric demand models. The baseline population forecast is from the Association of Bay Area Governments (ABAG).

Program Specification consists of parameterizing the conservation programs in the model. The model can hold up to 75 separate programs. The model can be extended to hold more than 75 programs if needed. Program parameters are grouped into five categories: water saving parameters, utility cost parameters, participant cost parameters, participant non water benefits parameters, and plumbing code parameters. The latter are used to specify interaction effects with plumbing codes to avoid double counting water savings jointly produced by plumbing codes and conservation programs. In terms of forecasting conservation program water savings, the most important parameters are the water savings parameters and the plumbing code interaction parameters.

Annual Activity is simply the number of units of activity that have been done (in the case of historical years) or are expected to be done (in the case of future years). The user enters historical and projected annual activity for each conservation program that was specified during the Program Specification step. For toilets, urinals, and clothes washers, the model includes fixture inventory modules to keep track of how many fixtures have been converted to efficient fixtures due to plumbing codes and conservation programs to ensure the user does not specify levels of fixture replacement that are physically infeasible.

Once the three data input tasks have been completed the model results can be reviewed. Model results are summarized into three categories: (1) program water savings, (2) retail water demand, and (3) costs and benefits.

- Program water savings are the projected annual water savings from each specified conservation program through 2045. Results can be grouped by program category and customer class or shown individually.

- Retail demand results summarize the baseline annual demand forecast with plumbing code and conservation program adjustments through 2045. It is grouped by customer class and shown separately for the in-city and suburban parts of SFPUC's retail service area. Results can be shown in MGD or acre-feet. Gross per capita and residential per capita water use are also reported. In addition, projected per capita water use is compared to per capita water use targets under SBx7-7 and the MOU.

- Costs and benefits of conservation are reported for the utility and program participant perspectives. Unit costs, net present value, and benefit-cost ratios can be reported for the totality of all programs, for individual program categories (e.g. toilet replacement programs), or for individual programs. In addition to financial benefits and costs, the model calculates expected reductions in associated energy use and greenhouse gas emissions.

Model inputs can be saved as scenarios. This allows the model to simultaneously hold more than one set of data inputs. For example, a user could specify scenarios for alternative baseline population and demand forecasts or for alternative levels of conservation program investment. There is no practical limit to the number of scenarios the model can hold.

Summary of Key Updates since 2015

2015 Updates

The conservation program savings presented in SFPUC's 2011 Conservation Plan were developed with the SFPUC's original Retail Demand Model not the Conservation Tracking Model. While the Conservation Tracking Model can be calibrated to replicate the 2011 estimates, the final estimates developed for the 2015 Conservation Plan, which were developed with the Conservation Tracking Model, were generally lower after 2020 than what was presented in the 2011 Plan for three main reasons:

- The SFPUC undertook a review of the water saving estimates and assumptions and made several adjustments, including to savings estimates for clothes washers and toilets, both of which were lowered to account for new efficiency standards affecting the long-term savings potential of these programs.

- The 2015 Plan updated the end dates for toilet and clothes washer incentives due to high fixture saturation levels.
- The 2015 Plan focused mainly on the next five years, reflecting that beyond that horizon, there is much less certainty regarding what conservation programs SFPUC will find most beneficial and cost-effective to implement.

2020 Updates
In 2020, the SFPUC made the following changes to the model:

- Revised future participation levels for several measures to better reflect current trends.
- Added several new conservation measures.
- Adjusted the water savings assumptions of several existing measures.
- Updated the water savings module for clothes washer efficiency standards to align it with the approach used in Version 4 of the Alliance for Water Efficiency's Water Conservation Tracking Tool.
- Incorporated the City of San Francisco Planning Department's current population and housing estimates and projections.
- Removed the calculation of plumbing code water savings for new development (post 2020) because they are already embedded in SFPUC's updated retail demand projections.

These updates were based on analysis of historical program participation, updated fixture saturation rates, and new empirical and other water-savings studies and data available since 2015. This document reflects the assumptions and specifications used in the SFPUC's Conservation Tracking Model for purposes of estimating water savings for the SFPUC's 2020 Retail Conservation plan.

Updated Population and Housing Projections

Both population and housing estimates have changed since the 2015 version of the conservation model due to new assumptions about growth in the City of San Francisco. The City has a goal of increased housing development on the order of 5,000 new units per year. However, as described elsewhere in this TM, SFPUC expects new construction to be built at code and generate no additional passive savings. All future passive savings will come from existing stock. As such, population and housing estimates for 2020 were updated, as described below, and then held constant for the remainder of the planning horizon.

Population Projection Update

The City of San Francisco Planning Department provided an updated 2020 population of 941,269. Residential population in 2020 was estimated from total population by subtracting 3%, which represents population housed in group quarters. This value is based on historical estimates from 2011-2020 from Department of Finance E-5 Housing and Population Estimates (dated May 2020), as well as P-4 Household Projections for California Counties for 2020-2030 (dated June 2020).

The conservation model's original and updated population projections are shown in Table 1. As shown in this table, the population stops growing after 2020 to reflect no additional passive savings to be generated from future growth.

Table 1: Population Projection Update

	Total Population			Residential Population		
Year	2015 Model	2020 Model	% Difference	2015 Model	2020 Model	% Difference
2005	780,187	780,187	0.0%	756,678	756,678	0.0%
2010	805,235	805,235	0.0%	780,971	780,971	0.0%
2015	857,508	857,508	0.0%	831,995	831,995	0.0%
2020	890,400	941,269	5.7%	863,800	913,031	5.7%
2025	934,800	941,269	0.7%	906,800	913,031	0.7%
2030	981,800	941,269	-4.1%	952,500	913,031	-4.1%
2035	1,032,500	941,269	-8.8%	1,000,800	913,031	-8.8%
2040	1,085,700	941,269	-13.3%	1,051,100	913,031	-13.1%
2045	1,085,700	941,269	-13.3%	1,051,100	913,031	-13.1%
2050	1,085,700	941,269	-13.3%	1,051,100	913,031	-13.1%

Source: 2020 total population from San Francisco Planning Department, adjusted to residential population based on 3% group quarters (DOF E-5 and P-4)

Household Projection Update

The City of San Francisco Planning Department provided an estimate of total housing units as of 2020 to the SFPUC in October 2020. This value is assumed to be a projection of total constructed housing units as opposed to occupied housing units.

Occupied single-family housing units in 2020 were set equal to the number of single-family residential accounts in the SFPUC's billing system as of August 2020. This includes the number of accounts with the service agreement type residential single family (RES-SWTR), regardless of dwelling unit count, and the service agreement type of residential combination service (COMBO-R) with 1 dwelling unit. Occupied single-family housing units for 2025 and beyond were kept the same as 2020.

Total 2020 housing units from the Planning Department were adjusted to estimate occupied housing units using a vacancy rate of 8.26%, which is an average of the last five estimates provided by the ACS 5-year estimates for the City of San Francisco from 2015-2019 (ranging 7.7% to 8.9%). Total occupied multi-family housing units in 2020 were estimated by subtracting the number of occupied single-family housing units in 2020 from the total 2020 occupied housing units.

2015 housing units for both single- and multi-family were interpolated between values used previously for 2010 and the updated inputs for 2020.

The conservation model's original and updated projections for total, single-, and multi-family housing units are shown in Table 2. As shown in this table, the 2020 housing units stop growing after 2020 to reflect no additional passive savings to be generated from future growth.

Table 2: Housing Projection Update

Year	Total Occupied Housing Units			Occupied Single-Family Housing Units			Occupied Multi-Family Housing Units		
	2015 Model	2020 Model	% Difference	2015 Model	2020 Model	% Difference	2015 Model	2020 Model	% Difference
2005	335,054	335,054	0.0%	109,500	109,500	0.0%	225,554	225,554	0.0%
2010	345,811	345,811	0.0%	110,759	110,759	0.0%	235,052	235,052	0.0%
2015	366,540	356,070	-2.9%	113,687	111,231	-2.2%	252,853	244,840	-3.2%
2020	377,684	366,330	-3.0%	115,073	111,702	-2.9%	262,611	254,628	-3.0%
2025	393,630	366,330	-6.9%	116,475	111,702	-4.1%	277,155	254,628	-8.1%
2030	410,227	366,330	-10.7%	117,894	111,702	-5.3%	292,333	254,628	-12.9%
2035	426,235	366,330	-14.1%	119,331	111,702	-6.4%	306,904	254,628	-17.0%
2040	442,905	366,330	-17.3%	120,785	111,702	-7.5%	322,120	254,628	-21.0%
2045	442,905	366,330	-17.3%	120,785	111,702	-7.5%	322,120	254,628	-21.0%
2050	442,905	366,330	-17.3%	120,785	111,702	-7.5%	322,120	254,628	-21.0%

Source: 2020 total housing units provided by San Francisco Planning Department and adjusted to account for occupancy using average vacancy rate from ACS 5-year estimates from 2015-2019. Count of single-family units equal to 2020 count of SFPUC single-family water accounts served with remainder allocated to multi-family units.

Calculation of Plumbing Code Water Savings

The Conservation Tracking Model calculates the water savings associated with plumbing codes and appliance efficiency standards using models of fixture inventory coupled with usage assumptions. These savings are commonly referred to as passive water savings because they occur regardless of actions taken by the utility. The Tracking Model includes passive savings models for residential toilets, showerheads, and clothes washers, and non-residential toilets, urinals, hotel showerheads, and coin-op clothes washers.

It is important to emphasize that the passive savings estimates do not actually impact the model's estimates of final water demand. This is because the Brattle Group's baseline demand forecasts used in the Tracking Model are net of passive water savings. However, the Brattle forecast does not generate an explicit forecast of passive water savings because the adjustment for passive savings is enacted through the model's trend term. Because SFPUC desired explicit estimates of passive water savings, modules for estimating these savings were included in the Conservation Tracking Model. These estimates are added to the Brattle Group's baseline forecast before it is used in the model so that they can be represented explicitly. It is the Brattle Group's baseline forecast adjusted for passive savings that is entered on the Model Setup worksheet. The adjusted baseline forecast is:[1]

Adjusted Baseline Forecast = Brattle Baseline Forecast + Passive Water Savings

The final demand forecast generated by the Conservation Tracking Model is then:

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[1] The passive water savings adjustment also includes water savings expected to be realized after 2015 from the historical implementation of SFPUC conservation programs prior to the start of the Brattle Group's baseline forecast. This is done to prevent the model from double counting these water savings.

Final Demand Forecast = Adjusted Baseline Forecast – Passive Water Savings – Program Water Savings

This is also equal to:

Final Demand Forecast = Brattle Baseline Forecast – Program Water Savings

This means the only determinants of the final demand forecast are the Brattle Baseline Forecast and the forecast of programmatic water savings from future implementation of SFPUC conservation programs. While the passive savings forecast is useful because it provides an estimate of how much demand reduction can be ascribed to plumbing codes and appliance standards, it does not actually affect the final estimate of future demand.

Following are descriptions of how passive savings are calculated for each fixture/appliance category. The SFPUC Plumbing Fixture Population and Efficiency Saturation Estimates Technical Memorandum issued on January 13, 2014 and included in Appendix A of the 2015 Retail Conservation Plan and the updated saturation estimates memo dated August 19, 2019, and included in appendices of the 2020 Retail Conservation Plan provide more details on fixture population and saturation estimates.

Residential Toilets

The population of residential toilets is based on SFPUC's forecasts of single and multi-family housing units. These forecasts are multiplied by the average number of toilets per dwelling unit, which are estimated from recent American Housing Survey data. The model uses an average of 2.22 and 1.26 toilets per dwelling unit for single and multi-family housing, respectively. Toilets installed in new housing constructed between 1991 and 2013 are assumed to be ULFT (1.6 gpf). Toilets installed in new housing constructed after 2013 are assumed to be HET (1.28 gpf). Toilets in existing housing constructed before 1991 are assumed to have an average flush volume of 3.5 gpf. Toilets in existing housing are assumed to be replaced at an annual rate of 3.1% per year. This is the average rate of residential toilet replacement reported in studies done by EBMUD and SCVWD. Existing toilets replaced between 1991 and 2013 are assumed to be replaced by ULFTs. Existing toilets replaced after 2013 are assumed to be replaced by HETs. Using this information, the model calculates the average flush volume for the inventory of new and existing toilets for each year between 1990 and 2064. Water savings per flush is calculated relative to the average flush volume in 1990. Average savings per flush is equal to the average flush volume in 1990 less the average flush volume in each year after 1990. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. The estimated number of flushes per year is equal to the residential population multiplied by the average daily per capita flush rate multiplied by 365. The residential population is derived from SFPUC's service area population forecasts. The average daily per capita flush rate of 4.8 is taken from the San Francisco Residential End Uses of Water Study.

Non-Residential Toilets

The population of non-residential toilets for the period 1990-2012 is taken from the Fixture Saturation Task Memo. The population of non-residential toilets for the period 2013-2064 is a linear extrapolation based on the forecast of service area population. The same assumptions used for residential toilets regarding flush volume of new toilets and replacement rate of existing toilets are used for non-residential toilets. The average flush volume of the toilet inventory and the water savings per flush relative to 1990 are calculated the same way as for residential toilets. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. Vickers (2001) estimates annual flushes by multiplying daily flushes by a 260-day work year. Male workers are assumed to flush toilets (as opposed to urinals) an average of one time per day while female workers are assumed to flush toilets an average of three times per day. Male workers are assumed to comprise 54% of the labor force, per City of San Francisco (2009). Total employment is taken from SFPUC's employment forecast.

Non-Residential Urinals

Based on an analysis of DBI data, the ratio of urinals to toilets is estimated to be 0.15. This ratio is applied to the estimated stock of non-residential toilets to estimate the stock of urinals. Urinals installed before 1992 are assumed to have an average flush volume of 2 gpf. Urinals installed between 1992 and 2013 are assumed to have an average flush volume of 1 gpd. Urinals installed in 2014 are assumed to have a flush volume of 0.5 gpf. Urinals installed after 2014 are assumed to have a flush volume of 0.125 gpf. Urinals are assumed to have the same replacement rate as toilets. The average flush volume of the urinal inventory and the water savings per flush relative to 1990 are calculated the same way as for residential and commercial toilets. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. To calculate total flushes per year, male workers are assumed to have a daily flush rate of 2, per Vickers (2001). Male workers are assumed to comprise 54% of the labor force, per City of San Francisco (2009). Total employment is taken from SFPUC's employment forecast.

Residential Showerheads

The population of residential showerheads is based on SFPUC's forecasts of single and multi-family housing units. These forecasts are multiplied by the average number of showerheads per dwelling unit, which are estimated from recent American Housing Survey data. The model uses an average of 1.34 and 1.21 showerheads per dwelling unit for single and multi-family housing, respectively. Showerheads installed in new housing constructed before 2005 are assumed to have an average flow rate of 2.3 gpm. Showerheads installed in new housing constructed between 2005 and 2017 are assumed to have an average flow rate of 2.0 gpm. Showerheads installed after 2017 are assumed to have an average flow rate of 1.8 gpm. Showerheads in existing housing are assumed to be replaced at an annual rate of 12% per year, per the Alliance for Water Efficiency. Using this information, the model calculates the average showerhead flow rate for the inventory of new and existing showerheads for each year between 2005 and 2064. Average savings per minute is equal to the average flow rate in 2005 less the average flow rate in each year after 2005. Annual water savings is calculated as the product of the average flow rate and the annual number of minutes for showering. The annual number of minutes for showering is equal to the average number of shower events per household per day multiplied by the average shower duration in minutes multiplied by the number of households multiplied by 365. An average of 2 shower events per day and an average duration of 9 minutes per shower event are taken from the San Francisco Residential End Uses of Water Study.[2] The number of residential housing units is taken from SFPUC's housing forecast.

Hotel Showerheads

The population of hotel showerheads is based on an estimate of the total number of hotel rooms in San Francisco. The model assumes one showerhead per room. Showerheads installed before 2005 are

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[2] The estimate of average number of shower events per day from the San Francisco Residential End Uses of Water Study is used directly in the single-family residential calculation. For the multi-family calculation, it is scaled by the ratio of multi-family to single-family persons per household to take into account the lower density in multi-family housing.

assumed to have an average flow rate of 2.5 gpm. Showerheads installed between 2005 and 2017 are assumed to have an average flow rate of 2.2 gpm. Showerheads installed after 2017 are assumed to have an average flow rate of 1.8 gpm. Showerheads are assumed to be replaced at an annual rate of 12% per year, per the Alliance for Water Efficiency. Using this information, the model calculates the average showerhead flow rate for the inventory of new and existing showerheads for each year between 2005 and 2064. Average savings per minute is equal to the average flow rate in 2005 less the average flow rate in each year after 2005. Annual water savings is calculated as the product of the average flow rate and the annual number of minutes for showering. The annual number of minutes for showering is equal to the average number of shower events per occupied room per day multiplied by the average shower duration in minutes multiplied by the number of occupied rooms multiplied by 365. An average of 1.34 shower events per day per occupied room and an average duration of 10 minutes per shower event are taken from the AWWARF Commercial End Uses of Water Study. The average hotel occupancy rate is based on a review of various estimates published on the internet of hotel occupancy in San Francisco.

Residential Clothes Washers

The stock of residential clothes washers is based on SFPUC's housing forecast and the average number of washers per dwelling unit. The average number of washers per dwelling unit is 0.937 for single-family and 0.41 for multi-family. The multi-family estimate includes both in-unit and common room washers. Existing washers are replaced at an annual rate of 9%, which is equivalent to assuming washers have an average useful life of 11 years, which is consistent with industry estimates. When a washer is replaced, it is replaced with either a conventional or high-efficiency (Energy Star) washer according to a forecast of market shares informed by market analyses done to support the setting of federal efficiency standards for washers. Water factors for new conventional and high-efficiency washers change over time in the model. Water factors for conventional washers are based on federal energy standards while water factors for high-efficiency washers are based on EPA Energy Star specifications. The average water factor for the stock of residential washers adjusts over the course of the forecast based upon the rate at which existing washers are replaced and new washers are added to the inventory. The model's accuracy in predicting water use by clothes washers is checked against water use benchmarks for 1997, 2007, and 2012 taken from residential end use studies. Washer utilization in single-family households is drawn from the San Francisco End Use of Water Study. Washer utilization in multi-family households scales down the single-family estimate to account for smaller average household size. Water savings are calculated relative to 2005 and are equal to the difference in water use assuming average washer efficiency in 2005 versus average washer efficiency in the forecast year.

Coin-op Clothes Washers

Estimates of passive water savings for coin-op clothes washers use the same methodology used for residential clothes washers. The natural replacement rate for coin-op washers is the average of estimates developed by the Alliance for Water Efficiency (11.1%) and the Department of Energy (13.3%). The stock of coin-op clothes washers is based on an internet search of coin-op washer facilities in San Francisco. The average number of washers per coin-op facility is taken from the Fixture Saturation Task Memo. The average number of loads per day is taken from a PG&E study of coin-op washer water and energy consumption. The water factors for new and replaced washers are based on existing federal efficiency regulations for commercial clothes washers.

Calculation of Programmatic Water Savings

The Conservation Tracking Model calculates the water savings associated with a program as the product of the estimated water savings per unit of activity and the amount of activity completed. These savings are commonly referred to as active water savings because they result from the utility's direct investment in conservation programs intended to reduce demand. In other words, the savings result from the utility's active pursuit of demand reduction.

In the Tracking Model, the user specifies a starting unit water savings for each program. The behavior and duration of the unit savings overtime can then be adjusted with the useful life, annual decay, and plumbing code interaction parameters. When the annual decay and plumbing code interaction parameters are both set to 0, annual savings is equal to the product of the initial unit savings and the amount of activity. Annual savings accrue until the measure's useful life is reached, after which annual savings are assumed to be zero. Thus given initial unit savings S_0, measure useful life u, and activity of A_s in year s, water savings in any year t ≥ s are:

$$S_t = A_s S_0 \; if \; t - s + 1 \leq u, 0 \; otherwise$$

When the annual decay parameter takes a value d in the range (0, 1], annual water savings in any year t ≥ s are:

$$S_t = A_s S_0 (1-d)^{t-s} \; if \; t - s + 1 \leq u, 0 \; otherwise$$

When the plumbing code interaction parameter takes a value p in the range (0, 1] and the plumbing code is in effect for any year t ≥ v, annual water savings in any year t ≥ s are:

$$S_t = \begin{cases} A_s S_0 \; if \; u \geq t - s + 1 \; and \; t < v \\ A_s (1-p)^{t-s} S_0 \; if \; t - s + 1 \leq u \; and \; t \geq v \\ 0 \; if \; t - s + 1 > u \end{cases}$$

When the plumbing code interaction parameter takes a value p in the range (0, 1], the plumbing code is in effect for any year t ≥ v, and the annual decay parameter takes a value d in the range (0, 1], annual water savings in any year t ≥ s are:

$$S_t = \begin{cases} A_s S_0 (1-d)^{t-s} \; if \; t - s + 1 \leq u \; and \; t < v \\ A_s (1-p)^{t-s} S_0 (1-d)^{t-s} \; if \; t - s + 1 \leq u \; and \; t \geq v \\ 0 \; if \; \; t - s + 1 > u \end{cases}$$

The specification of these parameters are based on current state and federal plumbing codes and appliance standards and findings from empirical evaluations of conservation program performance, as compiled by the California Urban Water Conservation Council (CUWCC) and Alliance for Water Efficiency (AWE). The specific data sources and assumptions used to create the water savings and plumbing code specifications for each program are provided in the remainder of this document.

The model's toilet fixture inventory modules for single- and multi-family toilets also estimate water savings from the City's toilet retrofit-on-resale ordinance that started in 2009. These estimates rest on two simplifying assumptions: (1) 3.5+ gpf toilets are uniformly distributed across the housing stock and

(2) each housing unit is equally likely to be put on the market for sale each year. Given these two assumptions, ROR toilet replacements in any year $t \geq 2009$ are calculated as:

(Stock of 3.5+ gpf toilets at beginning of year – SFPUC toilet replacements) x housing resale rate

The model assumes ROR toilets are replaced with ULFTs prior to 2014 and HETs thereafter.

Program Water Savings Specifications

The remainder of this document presents the water savings specifications for each conservation measure included in the Conservation Tracking Model. Program specifications are grouped first by customer class and second by programs type.

Confidence in Estimates

The program water savings specifications utilize the best available information on water savings. Only measures with a sufficient level of confidence in the approach to estimating water-savings are included in the Tracking Model. The SFPUC implements a number of measures that are not included in the model that are likely to generate some water savings but for which there are insufficient empirical studies or standard engineering estimates to generate estimates with a reasonable level of confidence. For the measures included in the model there is a range of reliability of savings estimates. While all measures in the tool meet a base level of confidence, for established and widely deployed measures – e.g. toilet replacements -- there is strong empirical evidence on water savings from multiple empirical program evaluations. In other cases, less data is available or the program is so new that empirical performance data is limited or nonexistent. In these cases, the water savings estimates may be based on results of a single evaluation done elsewhere or they may be built up from utilization and flow rate assumptions – commonly referred to as engineering estimates.

A confidence score of 1, 2 and 3 is assigned to each program specification to indicate the level of confidence in the water savings specification. The confidence scores are subjective in the sense that they rely on professional judgement as to the quality and applicability of the data underlying the water savings specification.

Confidence Score	**Criteria**
1	Savings are based on well-designed empirical evaluations of program performance. The program is widely deployed by other water suppliers and water savings have been evaluated in multiple locations and contexts. Savings estimates are directly applicable or can reasonably be re-scaled to be applicable to SFPUC’s service area.
2	Savings are based on simple empirics of program performance (e.g. a simple difference in means or difference-in-differences analysis). The program may not be widely deployed by other water suppliers and may not have been evaluated in multiple locations and contexts.
3	Empirical estimates of program performance are not available or are limited in their applicability to SFPUC’s service area. Savings are based on engineering estimates relying on general

assumptions about water use with and without the program intervention

Measure Summary Tables

The following tables summarize the measures in the model at the time of this update (August 2020). The tables provides:

- A brief description of each measure
- The unit savings estimate for the measure
- The basis for the estimate
- The expected annual water savings at the planned level of activity
- The confidence score for the water savings estimate

Link to Detailed Specifications
The measure IDs in the summary tables are hyperlinked to the measure's detailed specification. Ctr-clicking the specification ID will take the reader to the measure's detailed specification. Ctr-clicking the ID the detailed specification will take the reader back to the summary table.

Basis for Savings Estimates
The basis for the savings estimate is either:

Empirical Program Evaluations – the savings estimate is based on results from one or more empirical evaluations of water savings for similar programs. The empirical estimate may be adjusted to account for differences between the location(s) where the empirical evaluation was completed and SFPUC's service area. Such adjustments are explained in the measure's detailed specification.

Engineering Estimate – the savings estimate is based on assumptions about fixture/device utilization and the water-using properties of the existing and new fixture/device. Engineering estimates are generally less reliable than estimates based on empirical program evaluations.

Annual Savings Estimates
The annual savings estimates show the expected water savings from one year of planned annual activity. These savings would be expected to persist over the useful life of the measure. Savings for most measures are assumed to be stationary, meaning the model does not assume the savings will change significantly over its useful life. However, this assumption is not adopted for every measure. For example, the model assumes savings from surveys are not constant, but rather decrease with time. The estimates in the summary tables do not reflect these adjustments. Therefore, the estimates should be viewed as upper-bounds for measures whose savings are expected to decrease over time.

Single-Family Measures

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
S1	Mandatory CAP Audit	Free site evaluation required for single-family residents to participate in the SFPUC's Community Assistance Program (CAP) for discounted water and sewer rates. Identify inefficient plumbing fixtures and leaks and suggest improvements.	17.5 gpd	0	NA	Empirical Program Evaluations	Savings assumed to decay by 20% per year	2
S2	WaterWise Evaluation	Free indoor and outdoor site consultation: review consumption history, check plumbing fixtures and irrigation system components for leaks, determine fixture flow rates, recommend improvements, identify fixtures eligible for replacement through rebate programs, and provide standard repair parts for faulty toilets and free water-saving devices and materials. Customized report of findings sent to customer after visit.	17.5 gpd	500	9.8	Empirical Program Evaluations	Savings assumed to decay by 20% per year	2
S3a	Leak Alerts	SFPUC uses its AMI data to flag accounts that trigger continuous usage thresholds and alerts customers if a leak is suspected. SFPUC provides alerted customers with information on	0.7 gpd	109,000	85.5	Empirical Program Evaluations	Unit savings is per active Single-Family account	1

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		how to check for and repair common leaks						
S3b	Custom Water Use Report	Report with customers' water use information, comparison of water to similar properties, and customized information on ways to save.	8.4 gpd	0	NA	Empirical Program Evaluations	Multiple empirical evaluations have found home water reports reduce water use by 5-6%. The model assumes 5.5%.	1
S4	1.5 GPM Showerhead Distribution	Up to two free showerheads (as part of measure S2 or in-person pickup from SFPUC) per household.	6.8 gpd	500	3.6	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018. Assumes 54% installation rate	2
S5	1.5 GPM Showerhead Direct Install	Provides free installation of 1.5 gpm showerheads to single family residents. WaterWise Evaluation (S2) is a pre-requisite to this measure.	12.6 gpd	100	1.4	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018	1

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
S6	HET Rebate	Cash rebates of up to $125 to replace old toilets (3.5 gpf or more) with approved HETs (1.28 gpf or less).	20.9 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018. Direct install savings reduced by 25% to account for rebates used to replace ULF toilets and program free-riders	2
S7	CAP Direct Install thru SFPUC Funding	Free installation of HETs (1.28 gpf) for single-family residents who are also CAP participants. Only 3.5 gpf toilets replaced except a small number of old, poorly performing 1.6s. **Pre-requisite:** Mandatory CAP Audits (Measure S1).	27.8 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018	1
S8	HET Direct Install (Non-CAP)	Same as measure S7 but is open to single-family residents who are not a CAP participant. Program did not start until 2016	27.8 gpd	206	6.4	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit	1

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
							programs completed in 2018	
S9	HET Voucher	A voucher issued to eligible residents to replace their older toilets with HETs.	20.9 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018. Direct install savings reduced by 25% to account for rebates used to replace ULF toilets and program free-riders	2
S11	CEE Tier 3 Washer Rebate (WF 4.0)	Up to $100 rebate from SFPUC and $50 rebate from PG&E for a combined $150 rebate for a washer with 4 WF or lower.	10.2 gpd	0	NA	Engineering Estimate	Engineering estimate based on limited data on clothes washer market shares	3
S12	Energy Star Most Efficient Washer	Up to $100 rebate from SFPUC and $50 rebate from PG&E for a combined $150 rebate for a washer with 3.5 WF or lower.	11.6 gpd	80	1.0	Engineering Estimate	Engineering estimate based on limited data on clothes	3

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
	Rebate (WF 3.5)						washer market shares	
S16a	Rain Barrel Rebate	Subsidy program that discounts the purchase cost of rain barrel and provides training.	0.8 gpd	30	0.03	Engineering Estimate	60 gal capacity. Estimated with AWE Rain Barrel Harvest & Application Model	3
S16b	Rain Cistern Rebate	Subsidy program that discounts the purchase cost of cisterns and provides training.	2.4 gpd	15	0.04	Engineering Estimate	205 gal capacity. Estimated with AWE Rain Barrel Harvest & Application Model	3
S18	Weather-Based Irrigation Controller Rebate	Financial rebate towards purchase and installation of a weather-based irrigation controller that uses site specific data and adjusts the irrigation time depending on the local weather.	3.7 gpd	50	0.2	Empirical Program Evaluations	Estimate is based on review of empirical evaluations of WBIC savings in Southern and Northern CA	2
S20	Device Distribution	Various water-efficient fixtures: bathroom aerators (0.5/1.0/1.5 gpm), kitchen/bathroom laminar (1.5 gpm), kitchen aerators (1.5/2.2 gpm), utility aerators (1.5/2.0/2.2), pre-rinse spray nozzles, garden spray hose nozzles, toilet flappers, toilet fill valves, and soil moisture meters.	3.3 gpd	1600	5.9	Engineering Estimate	Based on review of end use studies and engineering estimates of savings potential of	3

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
							aerators and other devices	

Multi-Family Measures

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
M1	WaterWise Direct Installation Evaluation	Free, required site evaluation for multi-family residents to participate in the SFPUC's HET/Urinal Direct Install Program). Identify inefficient plumbing fixtures and leaks and suggest improvements.	10.6 gpd	206	2.4	Empirical Program Evaluations	Equal to indoor savings for S1 and S2. Savings assumed to decay by 20% per year	2
M2	WaterWise Evaluation	Free site consultation: review consumption history, check toilets for leaks, determine fixture flow rates, recommend improvements, identify fixtures eligible for replacement through rebate programs, provide standard repair parts for faulty toilets and free water-saving devices and materials.	10.6 gpd	500	5.9	Empirical Program Evaluations	Equal to indoor savings for S1 and S2. Savings assumed to decay by 20% per year	2
M3	Leak Alert	SFPUC uses its AMI data to flag 2-5 dwelling unit multi-family accounts that trigger continuous usage thresholds and alerts customers if a leak is suspected. SFPUC provides alerted customers with information on how to check for and repair common leaks	2 gpd	27,000	60.5	Empirical Program Evaluations	Unit savings applies to all Multi-Family customers with 2-5 dwelling units	1
M4	Showerhead Distribution	Buildings with 10 or less units are limited to one showerhead per unit. These buildings can pick up showerheads at the customer service counter. Also includes	6.8 gpd	700	5.3	Empirical Program Evaluations	Based on empirical evaluation of bathroom	2

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		buildings that receive showerheads that are not installed during a Water Wise Evaluation. Buildings with over 10 units must schedule a WaterWise Evaluation (measure M2) in order to receive the free devices					retrofit programs completed in 2018. Assumes 54% installation rate	
M5	Showerhead Direct Install	Free installation of showerheads. **Pre-requisite:** WaterWise Direct Install Evaluations (Measure M1)	12.6 gpd	200	2.8	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018	1
M6	HET Rebate	Cash rebates of up to $125 per tank-style HET or up to $300 per flushometer valve HET to replace a high-flow toilet (3.5 gpf or more).	30 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018. Direct install savings reduced by 25% to account for rebates used to replace ULF toilets and	2

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
							program free-riders	
M7	HET Direct Install	Free installation of tank-style (T) or flushometer valve (F) HETs. **Pre-requisite:** WaterWise Direct Install Evaluation (Measure M1)	38.6 gpd	300	13.0	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018	1
M8	HET Voucher	A voucher issued to eligible residents to replace their older toilets with HETs	30 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of bathroom retrofit programs completed in 2018. Direct install savings reduced by 25% to account for rebates used to replace ULF toilets and program free-riders	2
M9	HET Install thru On-Bill Financing	Partner with third-party vendors to find customers with remaining savings opportunity, sell them the	38.6 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluation of	1

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		program, and conduct the installation. The customer pays for the program through savings received through their water bill.					bathroom retrofit programs completed in 2018	
M10	CEE Tier 3 Washer Rebate (WF 4.0)	Rebate for coin-op, common area clothes washer with WF of 4 or lower. (multi-family in-unit residential style washers are covered under SF measure)	126 gpd	80	11.3	Engineering Estimate	Engineering estimate based on limited data on clothes washer market shares	3
M20	Device Distribution	Various water-efficient fixtures: bathroom aerators (0.5/1.0/1.5 gpm), kitchen/bathroom laminar (1.5 gpm), kitchen aerators (1.5/2.2 gpm), utility aerators (1.5/2.0/2.2), pre-rinse spray nozzles, garden spray hose nozzles, toilet flappers, toilet fill valves, and soil moisture meters.	3.3 gpd	2750	10.2	Engineering Estimate	Based on review of end use studies and engineering estimates of savings potential of aerators and other devices	3

Non-Residential Measures

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
N1	WaterWise Evaluations for Commercial Buildings	Free site consultation: review consumption history, check toilets for leaks, determine fixture flow rates, recommend improvements, identify fixtures eligible for replacement through incentive programs, provide standard repair parts for faulty toilets and free water-saving devices and materials. Customized report of findings sent after visit.	215 gpd	50	12.0	Empirical Program Evaluations	Based on empirical evaluations of CII surveys done in Southern California in the 1990s	3
N2	Commercial Direct Install Audits	Free site consultation similar to measure N1. Required for commercial buildings that applied for direct install programs.	215 gpd	0	NA	Empirical Program Evaluations	Based on empirical evaluations of CII surveys done in Southern California in the 1990s	3
N3	Surveys – Hospitals, Hotels, Schools	Free site consultation for hospitals, hotels, and schools	837 gpd	16	15.0	Empirical Program Evaluations	Based on empirical evaluations of CII surveys done in Southern California in the 1990s	3
N4	Surveys – Large Landscape by Contractors	Free landscape survey provided to eligible customers (0.5 acres or more of irrigated landscapes) under the Landscape Technical Assistance Program. Survey	161 gpd	30	5.4	Engineering Estimate	Unit savings per acre surveyed. Assumes 10% reduction in average landscape	3

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		will evaluate the water delivery system to check for inefficiencies that lead to water losses, Surveyors will also determine the site's water budget by cataloguing plant type and will create site-specific recommendations and a cost estimate for improving irrigation efficiency.					site water use of 1.8 AF/Acre	
N5	Surveys – CII Facilities by Contractors	Free site consultation for other types of non-residential customers provided by third-party consultant or other funding sources.	5120 gpd	3	17.2	Engineering Estimate	SFPUC staff estimate of water savings from consultant audits	2
N7	1.5 GPM Showerhead Giveaway	Provides free, high-efficiency 1.5 gpm showerheads for San Francisco businesses.	5.6 gpd	300	1.9	Engineering Estimate	Based on review of hotel end use studies and engineering estimates of hotel showerhead savings potential. Assumes 54% installation rate	3
N8	1.5 GPM Showerhead Direct Install	Free installation of high-efficiency 1.5 gpm showerheads for San Francisco businesses. **Pre-requisite:** Direct Install Audit (Measure N2)	10.4 gpd	100	1.2	Engineering Estimate	Based on review of hotel end use studies and engineering estimates of hotel showerhead savings potential.	3
N9	Device Distribution	Various water-efficient fixtures: bathroom aerators (0.5/1.0/1.5 gpm),	3.3 gpd	700	2.6	Engineering Estimate	Based on review of end use studies and	3

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		kitchen/bathroom laminar (1.5 gpm), kitchen aerators (1.5/2.2 gpm), utility aerators (1.5/2.0/2.2), pre-rinse spray nozzles, garden spray hose nozzles, toilet flappers, toilet fill valves, and soil moisture meters.					engineering estimates of savings potential of aerators and other devices	
N10	HET Rebate	Cash rebates of up to $125 per tank style toilet and up to $300 per flushometer valve toilet for replacing high-flow toilets (3.5 gpf or more) with approved HET models (1.28 gpf or less).	28.4 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2
N11	HET Rebate – Schools, Hotels, Muni	Cash rebates of up to $125 per tank style toilet and up to $300 per flushometer valve toilet for replacing high-flow toilets (3.5 gpf or more) with approved HET models (1.28 gpf or less).	20.6 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2
N12	HET Direct Install	Free installation of High-Efficiency Toilets for businesses in SF **Pre-requisite:** Direct Install Audit (Measure N2)	29 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
N13	HET Direct Install – Schools, Hotels	Free installation of HETs for schools or hotels in SF. **Pre-requisite:** Direct Install Audit (Measure N2)	19.6 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2
N14	HET Voucher	A voucher for HET purchase.	28.4 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2
N15	HET Voucher – Schools, Hotels	Same as N14 but directed at schools and hotels	17.8 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2
N16	HET Install thru On-Bill Financing	Partner with third-party vendors to find customers with savings opportunity, sell them the program, and conduct the installation. The customer pays for the program through savings received through their water bill.	29 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC CII Toilet Savings Study. Estimate scales-up ULFT savings to account for improved efficiency of HET	2

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
N17	HEU Rebate	Cash rebates of up to $300 per urinal for eligible commercial businesses when high flow urinals (1.5 gpf or more) are replaced with High-Efficiency Urinal (HEU) models that are 0.125 gpf or less.	16.2 gpd	0	NA	Empirical Program Evaluations	Based on CUWCC Urinal Savings Potential PBMP Study	3
N18	HEU Direct Install	A program for replacing 1.5 gallons per flush (gpf) high efficiency urinals with pint flush urinals.	16.2 gpd	0	NA	Engineering Estimate	Based on CUWCC Urinal Savings Potential PBMP Study	3
N20	Energy Star Washer Rebate (WF 4.5)	Measure has been discontinued. Cash rebates for commercial high-efficiency clothes washers with a water factor of 4.5 or below.	39 gpd	0	NA	Engineering Estimate	Engineering estimate based on limited data on clothes washer market shares and coin-op washer utilization rates	3
N21	Energy Star Washer Rebate (WF 4)	Cash rebates of up to $200 for commercial high-efficiency clothes washers with a water factor of 4.0 or below. For any business where 10 or more washers are being installed, a pre-purchase inspection must be scheduled.	45 gpd	40	2.0	Engineering Estimate	Engineering estimate based on limited data on clothes washer market shares and coin-op washer utilization rates	3
N22	Landscape Grants	Under Landscape Grant Program, landscapes with over 0.5 acre of irrigated areas are eligible to receive funding to implement retrofits and install	446 gpd/acre	11.2 acres (2 projects per year)	5.6	Empirical Program Evaluations	Based on SFPUC staff estimates of water savings for 11 large	2

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
		fixtures to facilitate water conservation.					landscape grant projects	
N24	Equipment Retrofit Rebate	Incentives to businesses to upgrade indoor equipment. Projects must achieve an annual water savings of 200 ccf or more to qualify. SFPUC will provide qualifying projects incentives of $0.50 per ccf over a 10-year lifespan up to 50% of the equipment costs. Program includes customized incentives as well as standard incentives for equipment with predictable water savings, such as water efficient ice machines, and connectionless food steamers.	2 gpd per dollar of grant funding	1 project (200 ccf/yr)	0.5		Minimum required savings per $1 of grant funding – e.g. if $100K awarded, expected savings would be 200,000 gpd	1
N25	Custom Equipment Retrofit Rebate	Similar to Measure N24, but allows applicants to create customized project tailored toward their specific business needs and water use patterns.	2 gpd per dollar of grant funding	1 project (200 ccf/yr)	0.5		Minimum required savings per $1 of grant funding – e.g. if $100K awarded, expected savings would be 200,000 gpd	1
N27	Kitchen Low Flow Spray Valves	Rebate or giveaway of high-efficiency kitchen spray valves used primarily by dishwashing stations	30 gpd	10	0.3	Empirical Program Evaluations	Based on multiple empirical evaluations of savings from kitchen spray-valve retrofits. Estimate assumes 50%	1

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings (AF)	Basis for Savings Estimate	Notes on Savings Estimate	Water Savings Estimate Confidence Score
							installation/retention rate	

Measures Applicable to All Customers

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings	Notes on Savings Estimate	Water Savings Estimate Confidence Score
A3	Irrigation Customer Large Landscape Budget	The SFPUC calculates how water use for irrigated landscape sites that received an irrigation or landscape grant or were required to comply with San Francisco's Water Efficient Irrigation Ordinance (WEIO) compares to the maximum allowable water use (MAWA) recommended for the plant types per state calculations. Staff are exploring how to potentially expand the program to all sites served by dedicated irrigation meters	357 gpd	TBD	Engineering Estimate	Unit savings per acre surveyed. Assumes 10% reduction in average pre-grant water use of 4 AF/Acre for 9 large landscapes enrolled in SFPUC landscape grant program	3
S16a	Rain Barrel Rebate	Subsidy program that discounts the purchase cost of rain barrel and provides training.	0.8 gpd	See Single-Family Table	Engineering Estimate	Originally specified as a single-family measure, multi-family and non-residential customers also can participate in the program. Currently single-family customer account for about 80% of program participants with the	3

ID	Measure Name	Measure Description	Expected Unit Water Savings (GPD)	Planned Annual Activity Level	Annual Water Savings	Notes on Savings Estimate	Water Savings Estimate Confidence Score
						other 20% split more or less evenly between multi-family and non-residential customers	
S16b	Rain Cistern Rebate	Subsidy program that discounts the purchase cost of cisterns and provides training.	2.4 gpd	See Single-Family Table	Engineering Estimate	See previous note	3

Single Family Measures

ID	Name	Class	Category
S1	Mandatory CAP Audit	Single Family	Audits & Reports

Water Savings: Average of savings from residential survey savings reported by Whitcomb (2000), A&N Technical Services (1994b), and Chesnutt, et al. (1995) is 33.9 gpd. Whitcomb (2000) reported 60% of savings are from outdoor uses and 40% are from indoor uses. Single family irrigation area in SFPUC retail service is approximately 34% of state average reported by DeOreo and Mayer (2010). Estimate based on combination of behavioral and fixture retrofits induced by survey recommendations. Savings from showerheads removed from indoor component to avoid double counting savings from S11 and S12. The 3 gpd estimate for showerheads assumes half the site visits get a direct install showerhead and half get a showerhead left for owner-installation, in which 50% are installed.

Water savings = (0.4 x 33.9 gpd – 3 gpd) + 0.6 x 0.34 x 33.9 gpd = 17.5 gpd (6,388 gpy)

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: 20%. Lower-end of decay rate range reported in CUWCC (2005).

Useful Life: 5 yrs. Based on typical useful life of survey savings reported in CUWCC (2005).

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year, 80% of outdoor savings occur in peak period. Peak period runs from May 1 to Sep 30, representing 42% of days.

Peak % = 0.42 x (0.4 x 33.9 gpd – 3 gpd) + 0.8 x 0.6 x 0.34 x 33.9 gpd)/17.5 = 57%

Unit Sewer Savings: Sewer savings = 0.4 x 33.9 gpd – 3 gpd = 10.6 gpd (3,869 gpy)
Wastewater to water savings ratio = 0.606

Unit Electricity Savings: NA

Unit Gas Savings: Assumes energy requirement of 0.0072 therms/gal for hot water heating, per DOE (2006), that hot water comprises 67% of shower/faucet flow - per DOE (2006) – that half of indoor water savings involve reductions in shower/faucet flow, and that indoor savings comprise 66% of total survey savings.

Gas savings = 0.0072 therms/gal x 0.67 x 0.5 x 0.66 = 0.0016 therms/gal

Confidence Score: 2

ID	Name	Class	Category
S2	WaterWise Evaluations	Single Family	Audits & Reports

All assumptions same as S1.

ID	Name	Class	Category
S3a	Leak Alerts	Single Family	Audits & Reports

Water Savings: Detailed empirical analysis of SFPUC's Single-Family Customer Leak Alert Program concluded:

- The Program reduced the mean duration of leak events lasting 72 or more hours by 31.5%, from 313.0 hours to 214.5 hours.
- The Program reduced the frequency of leak events lasting 72 or more hours by 39.5%, from 0.000425 to 0.000257 leaks per customer-day.
- The mean leak flow rate before the Program was 1.30 CF per hour. This increased 10.8% to 1.44 CF per hour with the Program.
- Given a base of 109,000 meters, the expected annual water loss without the Program is 51.5 MG and with the Program is 23.6 MG, a decrease of 54%.

This translates to an expected annual water savings rate of 256 gpy per single-family meter enrolled in the leak alert program.

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 1 year.

Peak Period Savings Percent: We assume the same savings pattern as S1 and S2 – where outdoor savings comprise 34% of total savings and 80% of outdoor savings occur in the peak period.

Peak period runs from May 1 to Sep 30, representing 42% of days.

Peak % = 0.42 x 0.66 + 0.8 x 0.34 = 55%

Unit Sewer Savings: We do not have data on how leakage is distributed between indoor and outdoor water uses. We assume the same distribution as indoor and outdoor water use.
Sewer savings = 0.66 x 256 gpy per meter = 169 gpy per meter
Wastewater to water savings ratio = 0.66

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 1

ID	Name	Class	Category
S3b	Custom Water Use Report	Single Family	Audits & Reports

Water Savings: Average water savings are 5.5% of single family daily use, per Mitchell and Chesnutt (2014). Multiple other empirical estimates of water use report savings have measured average saving rates of 4-6% (https://www.watersmart.com/resources/). Median single family water use in SFPUC's retail service area (circa 2005) is 153 gpd, per DeOreo and Mayer (2010a).

Water savings = 0.055 x 153 gpd = 8.4 gpd (3,066 gpy)

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 1 year.

Peak Period Savings Percent: Evaluations of water use reports have not had sufficient data to detect seasonal effects (Mitchell and Chesnutt, 2014). For now we assume the same savings pattern as S1 and S2 – where outdoor savings comprise 34% of total savings and 80% of outdoor savings occur in the peak period.

Peak period runs from May 1 to Sep 30, representing 42% of days.

Peak % = (0.42 x 0.66 x 8.4 gpd + 0.8 x 0.34 x 8.4 gpd) ÷ 8.4 = 55%

Unit Sewer Savings: Evaluations of water use reports have not had sufficient data to determine indoor and outdoor savings as a share of total (Mitchell and Chesnutt, 2014). For now we assume the same savings pattern as S1 and S2 – where indoor savings comprise 66% of total savings

Sewer savings = 0.606 x 8.4 gpd = 5.09 gpd (1,858 gpy)
Wastewater to water savings ratio = 0.606

Unit Electricity Savings: NA

Unit Gas Savings: Assumes energy requirement of 0.0072 therms/gal for hot water heating, per DOE (2006), that hot water comprises 67% of shower/faucet flow - per DOE (2006) – that half of indoor water savings involve reductions in shower/faucet flow, and that indoor savings comprise 66% of total savings.

Gas savings = 0.0072 therms/gal x 0.67 x 0.5 x 0.66 = 0.0016 therms/gal

Confidence Score: 1

ID	Name	Class	Category
S4	1.5 GPM Showerheads Distributions	Single Family	HESH

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Mean savings for showerheads installed in single-family households was 12.6 gpd. Field studies of retrofit kit distributions in Irvine (A&N Technical Services 1992d) and Los Angeles (A&N Technical Services 1991) have found initial installation probabilities that range from 49% to 59%. We assume a 54% installation probability.

Water savings = 0.54 x 12.6 gpd = 6.8 gpd (2482 gpy)

Plumbing Code Savings: Zero. SB 407 mandates showerheads have a maximum capacity of 2.5 gpm. Currently, the average flow rate of showerheads in SFPUC's retail service area is 1.95, per DeOreo and Mayer (2010a).

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 8 yrs, per Alliance for Water Efficiency (2014).

Peak Period Savings Percent:
Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 6.8 gpd (2482 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: Assumes energy requirement of 0.0072 therms/gal for hot water heating, per DOE (2006) and that hot water comprises 67% of shower/faucet flow - average of DOE (2006) and Aquacraft (1999). Gas savings = 0.0072 therms/gal x 0.67 = 0.0048 therms/gal

Confidence Score: 2

ID	Name	Class	Category
S5	1.5 GPM Showerheads Direct Install	Single Family	HESH

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Mean savings for showerheads installed in single-family households was 12.6 gpd (4599 gpy).

Unit Sewer Savings: Sewer savings = 12.6 gpd (4599 gpy)
Wastewater to water savings ratio = 1.000

All other assumptions same as S4.

Confidence Score: 1

ID	Name	Class	Category
S6	HET Rebates (Tank)	Single Family	HET

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Installed HETs had flush rates of 1.1 gpf or less. Mean savings for HETs installed in single-family households was 27.8 gpd (10147 gpy). Direct installation programs can more effectively screen out the replacement of ULF toilets than can rebate programs. Nearly all the toilets replaced in the direct installation programs evaluated by M.Cubed and A&N Technical Services were older non-ULFT toilets. Rebate programs may inadvertently issue rebates for the replacement of ULF toilets. To account for this possibility, mean daily savings estimated for the direct installation programs is reduced by 25%.

Water savings = 27.8 gpd x 0.75 = 20.9 gpd (7629 gpy)

Plumbing Code Savings: Effective Jan 1, 2014, same as water savings

Plumbing Code NRR: 3% per M.Cubed (2014)

Annual Decay Rate: NA. Leakage and double flushing assumed no worse than toilets replaced.

Useful Life: NA. Plumbing code ensures toilet cannot revert to lower efficiency. Period of savings attributed to program does not exceed useful life of toilet. On average savings are counted for 25 years, the average useful life of the toilet.

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 20.9 gpd (7629 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 2

ID	Name	Class	Category
S7	CAP Direct Install thru SFPUC Funding	Single Family	HET

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Installed HETs had flush rates of 1.1 gpf or less. Mean savings for HETs installed in single-family households was 27.8 gpd (10147 gpy).

Plumbing Code Savings: Effective Jan 1, 2014, same as water savings

Plumbing Code NRR: 3% per M.Cubed (2014)

Annual Decay Rate: NA. Leakage and double flushing assumed no worse than toilets replaced.

Useful Life: NA. Plumbing code ensures toilet cannot revert to lower efficiency. Period of savings attributed to program does not exceed useful life of toilet. On average savings are counted for 33 years, the average useful life of the toilet.

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 27.8 gpd (10147 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 1

ID	Name	Class	Category
S8	HET Direct Install (Non-Cap)	Single Family	HET

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Installed HETs had flush rates of 1.1 gpf or less. Mean savings for HETs installed in single-family households was 27.8 gpd (10147 gpy).

Plumbing Code Savings: Effective Jan 1, 2014, same as water savings

Plumbing Code NRR: 3% per M.Cubed (2014)

Annual Decay Rate: NA. Leakage and double flushing assumed no worse than toilets replaced.

Useful Life: NA. Plumbing code ensures toilet cannot revert to lower efficiency. Period of savings attributed to program does not exceed useful life of toilet. On average savings are counted for 33 years, the average useful life of the toilet.

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 27.8 gpd (10147 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 1

ID	Name	Class	Category
S9	HET Vouchers	Single Family	HET

All assumptions same as S6.

ID	Name	Class	Category
S11	CEE Tier 3 Rebate (WF 4.0)	Single Family	HEW

Water Savings: Assumes participant in market for washer. Without rebate, participant will purchase either top- or front-load washer. Current market share (circa 2012) of top-load washers is 52%, per DOE (2012). Current Energy Star market share (circa 2012) is 50%, per DOE (2012). Maximum allowed WF for Energy Star washer after 2011 is 6. Maximum allowed WF for non-Energy Star washer is 9.5, per National Appliance Standard. (National Appliance Standard changes in 2015 to 4.5 WF for front-load and 8.0 WF for top-load, and again in 2018 to 6.0 WF for top-load). Average WF of new washer is:

Avg WF of New Washer Without Rebate = 0.5 x 6.0 + 0.5 x 9.5 = 7.75 (note this will overstate avg WF after 2015 due to nat'l appl stdrd)

Average washer loads per day for single family households in SFPUC retail service area is 0.91, per DeOreo and Mayer (2010a). Average volume of new clothes washer is 3 cubic feet, per DOE (2012).

Water savings = (7.75 – 4.0) x 3 x 0.91 = 10.2 gpd (3,723 gpy)

Plumbing Code Savings: Effective Jan 1, 2015, appliance standard is 4.5 WF for front-load and 8.0 WF for top-load. Given current front- and top-load market shares and Energy Star market share, average WF under appliance standard in 2015 is:

2015 Avg WF under Nat'l Appl Std = 0.52 x (0.5 x 8.0 + 0.5 x 6.0) + 0.48 x 4.5 = 5.8

Effective Jan 1, 2018, appliance standard is 4.5 WF for front-load and 6.0 for top-load. Average WF under appliance standard in 2018 is:

2018 Avg WF under Nat'l Appl Std = 0.52 x 6.0 + 0.48 x 4.5 = 5.3.

For modeling conservation program benefits, we use the average of these two water factors – 5.6 -- and start the standard in 2015. Plumbing code savings starting in 2015 are:

Plumbing code savings = (7.75 – 5.6) x 3 x 0.91 = 5.9 gpd (2,154)

Plumbing Code NRR: 7.1%. Based on average washer life of 14 years, per DOE (2012).

Annual Decay Rate: NA

Useful Life: 14 years, per DOE (2012)

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 10.2 gpd (3,723 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: 0.0036 KWh/gal. Based on high efficiency washer electricity savings reported in FEMP (2000).

Unit Gas Savings: 0.0035 therms/gal. Based on high efficiency washer gas savings reported in FEMP (2000).

Confidence Score: 3

ID	Name	Class	Category
S12	Energy Star Most Efficient (WF 3.5) Washer Rebate	Single Family	HEW

Water Savings: See S11 for details.

Water savings = (7.75 – 3.5) x 3 x 0.91 = 11.6 gpd (4,234 gpy)

Unit Sewer Savings: Sewer savings = 11.6 gpd (4,234 gpy)
Wastewater to water savings ratio = 1.000

All other assumptions same as S11.

Confidence Score: 3

ID	Name	Class	Category
S16a, S16b	Rain Barrels and Cisterns	Single Family, Multi Family, Non-Residential	Grants

Water Savings: Savings based on M.Cubed Rain Barrel Harvest & Application Model (rainbarrel_harvest_and_application_model.xlsx)

60 gal barrel = 302 gpy (assumes 100 sqft irr area)
205 gal cistern = 887 gpy (assumes 300 sqft irr area)

The rain barrel water savings model simulates rain barrel catchment, filling, and application of stored water using daily rainfall and ETO data for the period 2/5/2001 to 10/22/2014. Daily weather data are from the Union City CIMIS weather station. The 60 gallon barrel savings estimate assumes a catchment area of 1000 square feet, irrigation area of 100 square feet, and landscape crop water coefficient (KL) of 0.25. The 205 gallon cistern savings estimate assumes irrigation area is 300 square feet. The other model assumptions are the same. Daily application of stored water is equal to the lesser of daily irrigation requirement and stored water. Daily irrigation requirement in cubic feet is equal to irrigation area x KL x net ETO ÷ 12.

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 15 years. Assumed

Peak Period Savings Percent: 24%. Calculated with M.Cubed Rain Barrel Harvest & Application Model for a 100 gal. barrel. Peak period savings % increases with barrel size, since more water can be stored for use in peak season.

Unit Sewer Savings: NA

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 3

ID	**Name**	**Class**	**Category**
S18	WBIC	Single Family	Grants

Water Savings: Several empirical program evaluations of WBIC performance have been completed since the early 2000s. A good summary of these studies can be found on the Cal WEP website. The following table summarizes findings from these studies.

Study	% Reduction in Outdoor Water Use	% Reduction in Total Household Water Use	Mean Reduction in Gal/Day	Sample Size
Orange County 2001	16-24%	7-10%	37-57	40 SF Homes
Orange County 2004	No estimate	10%	41	97 SF Homes
No & So Cal, 2009	7%	No estimate	58	1,987 SF Homes
Orange County 2010	10%	7%	37	899 SF Homes
Orange County 2011	No estimate	9%	49	70 SF Homes

The mean percentage reduction in outdoor water use estimated by these studies range from 7 to 24%. We are inclined to give more weight to the 2009 and 2010 studies that had large sample sizes. The mean percentage reduction in outdoor water use was 7-10%. We use the lower end of the range to be conservative.

Median single family water use in SFPUC's retail service area (circa 2005) is 153 gpd, per DeOreo and Mayer (2010a). On average, outdoor water use is assumed to be 34% of total water use. Expected WBIC savings are thus: 153 x 0.34 x 0.07 = 3.7 gpd or 1,351 gpy.

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 10 years. Assumed

Peak Period Savings Percent: 100% of savings assumed to occur in peak season.

Unit Sewer Savings: NA

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 2

ID	**Name**	**Class**	**Category**
S20	Device Distribution	Single Family	Grants

Water Savings: Water savings are a quantity-weighted average of devices distributed by SFPUC. The devices, quantity weights, and annual savings are shown in the following table.

Devices	Annual Quantity	Savings (GPY)	
1.5 gpm bathroom aerator	8229	210	
1.0 gpm bathroom aerator	0	361	
0.5 gpm bathroom aerator	1537	511	
1.5 gpm kitchen laminar	0	210	
1.5 gpm bathroom laminar	0	210	
2.2 gpm kitchen aerator	265	0	
1.5 gpm kitchen aerator	4641	210	
1.5 utility aerator	54	210	
2.0 utility aerator	54	60	
2.2 utility aerator	16	0	
Garden spray hose nozzle	295	0	No reliable estimates
Toilet flapper	3603	1212	
Toilet fill valves	1819	1212	Assumed to be same as flapper savings
Soil moisture meter	7	0	No reliable estimates
Total	20520		
Weighted Avg Savings		491	

Annual savings for aerators are based on the following data and assumptions:

- Median SFR faucet use is 29 gpd (source: Aquacraft SFPUC End Use Study).
- An average of 4 faucets per household is assumed.
- Average use per faucet is 7.25 gpd. The calculation assumes uniform faucet usage, which while unlikely to be true is necessary given lack of data on faucet use.
- Aerators reduce free flowing faucet water consumption. It is assumed half of faucet use is for free flowing uses (e.g. brushing teeth or washing vegetables) and half is for fixed volume uses (e.g. filling pots or getting a drink of water). Free flowing faucet use is therefore 3.63 gpd.
- Average faucet flow is assumed to be 2.2 gpm. Therefore, faucets average 1.6 minutes of free flowing use per day.
- It is assumed half of distributed faucets are installed.

Given these assumptions, savings by aerator flow rate are:

Aerator flow rate (gpm)	Avg Use GPD	Potential Savings (GPD)	Install %	Actual Savings (GPD)	Actual Savings (GPY)
2.2	3.63	0.00	50%	0.00	0
2.0	3.30	0.33	50%	0.16	60
1.5	2.47	1.15	50%	0.58	210
1.0	1.65	1.98	50%	0.99	361
0.5	0.82	2.80	50%	1.40	511

Annual savings for flappers and fill valves are based on the following data and assumptions:

- Median SFR leakage rate is 8.3 gpd, per Aquacraft SFPUC End Use Study.
- According to 2004 CUWCC Toilet Flapper Study and 1999 Residential End Use Study most household water leaks can be attributed to toilets. It is assumed toilet leaks account for 80% of the median leakage rate, or 6.64 gpd.
- It is assumed replacing flapper or fill valves will eliminate toilet-related leakage.
- It is assumed half of distributed flappers and fill valves are installed.

Given these assumptions, water savings are 3.32 gpd, or 1212 gpy.

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 5 years

Peak Period Savings Percent:

Unit Sewer Savings: Same as water savings

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 3

Multi Family Measures

ID	Name	Class	Category
M1	WaterWise Direct Install Evaluations	Multi Family	Audits & Reports

Water Savings: Assumes same as indoor share of savings for S1 and S2

Water savings = 10.6 gpd (3,869 gpy)

Plumbing Code NRR: NA

Annual Decay Rate: 20%. Same as S1 and S2. Lower-end of decay rate range reported in CUWCC (2005).

Useful Life: 5 yrs. Same as S1 and S2. Based on typical useful life of survey savings reported in CUWCC (2005).

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 10.6 gpd (3,869 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: Assumes energy requirement of 0.0072 therms/gal for hot water heating, per DOE (2006), that hot water comprises 67% of shower/faucet flow - per DOE (2006) – that half of indoor water savings involve reductions in shower/faucet flow, and that indoor savings comprise 100% of total survey savings.

Gas savings = 0.0072 therms/gal x 0.67 x 0.5 x 1.00 = 0.0024 therms/gal

Confidence Score: 2

ID	**Name**	**Class**	**Category**
M2	WaterWise Evaluations	Multi Family	Audits & Reports

All assumptions same as M1.

ID	Name	Class	Category
M3	Leak Alerts	Multi Family	Audits & Reports

Water Savings: Detailed empirical analysis of SFPUC's Multi-Family Customer Leak Alert Program concluded:

- The Program reduced the mean duration of leak events lasting 72 or more hours by 23%, from 325.1 hours to 249.5 hours.
- The Program reduced the frequency of leak events lasting 72 or more hours by 31%, from 0.00139 to 0.00096 leaks per customer-day.
- The Program had no effect on the mean flow rate of leaks, which was 1.29 CF/Hr for both the pre- and post-program periods.
- Given a base of 27,000 meters, the expected annual water loss without the Program is 43 MG and with the Program is 23 MG, a decrease of 47%.

This translates to an expected annual water savings rate of 741 gpy per multi-family meter served.

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 1 year.

Peak Period Savings Percent: We assume leaks are more or less distributed uniformly across the year.

Peak period runs from May 1 to Sep 30, representing 42% of days.

Unit Sewer Savings: We do not have data on how leakage is distributed between indoor and outdoor water uses. We assume multi-family water use is dominated by indoor water uses and so too are water savings from leak alerts.
Sewer savings = 0.9 x 741 gpy per meter = 667 gpy per meter
Wastewater to water savings ratio = 0.9

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 1

ID	Name	Class	Category
M4	Showerheads Distributions	Multi Family	HESH

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Mean savings for showerheads installed in multi-family households was 12.6 gpd. Field studies of retrofit kit distributions in Irvine (A&N Technical Services 1992d) and Los Angeles (A&N Technical Services 1991) have found initial installation probabilities that range from 49% to 59%. We assume a 54% installation probability.

Water savings = 0.54 x 12.6 gpd = 6.8 gpd (2482 gpy)

Plumbing Code Savings: Zero. SB 407 mandates showerheads have a maximum capacity of 2.5 gpm. Currently, the average flow rate of showerheads in SFPUC's retail service area is 1.95, per DeOreo and Mayer (2010a).

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 8 yrs, per Alliance for Water Efficiency (2014).

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 6.8 gpd (2482 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: Assumes energy requirement of 0.0072 therms/gal for hot water heating, per DOE (2006) and that hot water comprises 67% of shower/faucet flow - average of DOE (2006) and Aquacraft (). Gas savings = 0.0072 therms/gal x 0.67 = 0.0048 therms/gal

Confidence Score: 2

ID	Name	Class	Category
M5	Showerheads Direct Install	Multi Family	HESH

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Mean savings for showerheads installed in multi-family households was 12.6 gpd (4599 gpy).

Unit Sewer Savings: Sewer savings = 12.6 gpd (4599 gpy)

All other assumptions same as M4.

Confidence Score: 1

ID	Name	Class	Category
M6a	HET Rebate (Tank)	Multi Family	HET

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Installed HETs had flush rates of 1.1 gpf or less. Mean savings for HETs installed in multi-family households was 38.6 gpd (14089 gpy). Direct installation programs can more effectively screen out the replacement of ULF toilets than can rebate programs. Nearly all the toilets replaced in the direct installation programs evaluated by M.Cubed and A&N Technical Services were older non-ULFT toilets. Rebate programs may inadvertently issue rebates for the replacement of ULF toilets. To account for this possibility, mean daily savings estimated for the direct installation programs is reduced by 25%.

Water savings = 38.6 gpd x 0.75 = 30.0 gpd (10950 gpy)

Plumbing Code Savings: Effective Jan 1, 2014, same as water savings

Plumbing Code NRR: 3% per M.Cubed (2014)

Annual Decay Rate: NA. Leakage and double flushing assumed no worse than toilets replaced.

Useful Life: NA. Plumbing code ensures toilet cannot revert to lower efficiency.

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 30.0 gpd (10950 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 2

ID	Name	Class	Category
M6b	HET Rebate (Flushometer)	Multi Family	HET

All assumptions same as M6a.

ID	Name	Class	Category
M7a	HET Direct Install (Tank)	Multi Family	HET

Water Savings: M.Cubed and A&N Technical Services (2018a, 2018b) estimated toilet, showerhead, and aerator water savings from direct installation bathroom retrofit programs in Bakersfield, Torrance, and East Los Angeles targeting both single- and multi-family bathrooms. Installed HETs had flush rates of 1.1 gpf or less. Mean savings for HETs installed in multi-family households was 38.6 gpd (14089 gpy).

Plumbing Code Savings: Effective Jan 1, 2014, same as water savings

Plumbing Code NRR: 3% per M.Cubed (2014)

Annual Decay Rate: NA. Leakage and double flushing assumed no worse than toilets replaced.

Useful Life: NA. Plumbing code ensures toilet cannot revert to lower efficiency.

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 38.6 gpd (14089 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 1

ID	Name	Class	Category
M7b	HET Direct Install (Flushometer)	Multi Family	HET

All assumptions same as M7a.

ID	Name	Class	Category
M8	HET Voucher	Multi Family	HET

All assumptions same as M6a.

ID	Name	Class	Category
M9	HET/Fixture Install thru On-Bill Financing	Multi Family	HET

All assumptions same as M7a.

ID	Name	Class	Category
M10	CEE Tier 3 Rebate (WF 4.0)	Multi Family	HEW

Water Savings: Assumes rebates are for common area laundry rooms, not individual apartments. Without rebate, participant will purchase either top- or front-load washer. Current market share (circa 2012) of top-load washers is 52%, per DOE (2012). Current Energy Star market share (circa 2012) is 50%, per DOE (2012). Maximum allowed WF for Energy Star washer after 2011 is 6. Maximum allowed WF for non-Energy Star washer is 9.5, per National Appliance Standard. (National Appliance Standard changes in 2015 to 4.5 WF for front-load and 8.0 WF for top-load, and again in 2018 to 6.0 WF for top-load). Average WF of new washer is:

Avg WF of New Washer Without Rebate = 0.5 x 6.0 + 0.5 x 9.5 = 7.75 (note this will overstate avg WF after 2015 due to nat'l appl stdrd)

Average washer loads per day is 8.4, per M.Cubed (2014). Average volume of new clothes washer for common area use is assumed to be 4 cubic feet.

Water savings = (7.75 – 4.0) x 4 x 8.4 = 126 gpd (45,990 gpy) [Get energy star commercial list]

Plumbing Code Savings: Effective Jan 1, 2015, appliance standard is 4.5 WF for front-load and 8.0 WF for top-load. Given current front- and top-load market shares and Energy Star market share, average WF under appliance standard in 2015 is:

2015 Avg WF under Nat'l Appl Std = 0.52 x (0.5 x 8.0 + 0.5 x 6.0) + 0.48 x 4.5 = 5.8

Effective Jan 1, 2018, appliance standard is 4.5 WF for front-load and 6.0 for top-load. Average WF under appliance standard in 2018 is:

2018 Avg WF under Nat'l Appl Std = 0.52 x 6.0 + 0.48 x 4.5 = 5.3.

For modeling conservation program benefits, we use the average of these two water factors – 5.6 -- and start the standard in 2015. Plumbing code savings starting in 2015 are:

Plumbing code savings = (7.75 – 5.6) x 4 x 8.4 = 72 gpd (26,280)

Plumbing Code NRR: 7.1%. Based on average washer life of 14 years, per DOE (2012).

Annual Decay Rate: NA

Useful Life: 14 years, per DOE (2012)

Peak Period Savings Percent: Assumes indoor savings evenly distributed through year. Peak period runs from May 1 to Sep 30, representing 42% of days. Peak % = 42%

Unit Sewer Savings: Sewer savings = 126 gpd (45,990 gpy)
Wastewater to water savings ratio = 1.000

Unit Electricity Savings: 0.0036 KWh/gal. Based on high efficiency washer electricity savings reported in FEMP (2000).

Unit Gas Savings: 0.0035 therms/gal. Based on high efficiency washer gas savings reported in FEMP (2000).

Confidence Score: 3

ID	Name	Class	Category
N27	Kitchen Low Flow Spray Valves	Non Residential	Grants

All assumptions taken directly from the SFPUC Retail Demand Model. The SFPUC Retail Demand Model used a daily water savings estimate of 30 gpd (10,950 gpy) and fixture useful life of 10 years. The estimate is based on empirical estimates of daily savings (60 gpd) and a 50% installation and retention rate.

Confidence Score: 1

ID	Name	Class	Category
A3	Irrigation Customer Landscape Budgets	Non Residential	Audits & Reports

Water Savings: Many water suppliers have adopted water budgets for their large landscapes, which provides an effective way for both managing and evaluating large landscape programs. Landscape budgets are a form of customer education/information designed to help customers irrigate landscape efficiently. The effectiveness of this intervention can vary significantly depending on existing water use practices, types of landscapes subject to budgets, types of customers receiving budgets, cost of water, etc. There have been several empirical evaluations of landscape budget performance. Cal WEP provides a good summary of these studies.

The impact of landscape education on compliance with water budgets was evaluated in Orange County, California in a 2004 study. The education component was targeted at landscape contractors and property managers at home-owner associations (HOAs). The results were based on the experience of 47 HOAs that had participated in the program up to that point. The impact evaluation concluded that early participants in the program reduced their water demand by 9%, later participants by 20% (the difference between early and later participants was not explained).

Several studies are available that examine the impact of budget-based rates on large landscape water use. An early study, published in 1997 showed that tiered rates tied to landscape water budgets can reduce irrigation demand by about 20-25%.

Cal WEP compiled data from 12 Bay Area retailers on actual water use versus budget for a sample of large landscapes. On average, actual use exceeded budgeted use by 33%. Cal WEP also compared budget exceedence by type of customer. It found budget exceedence was greatest for HOAs and commercial properties (excluding gold courses) and lowest for parks and schools. The average exceedence for HOAs and commercial was 23% and 34%, respectively; for parks and schools it was 10% and 5%, respectively.

This measure assumes budgets would reduce large landscape water use by 10%, on average. This is at the lower-end of the savings range from empirical studies and significantly less than the average budget exceedence for the sample of 12 Bay Area water agencies. A conservative savings assumption is deemed appropriate because:

- Parks and schools, which tend to have lower budge exceedence, comprise most of the large landscape area in SFPUC's retail service area.
- SFPUC's high retail water rates already discourage wasteful irrigation and landscape water use.
- SFPUC's cool summer climate results in lower irrigation application rates relative to other parts of California with dryer, hotter summer climates.

The average pre-grant irrigation application rate at large landscape sites participating in SFPUC's large landscape grant program is 4 AF/acre (see N22).

Savings = 4 AF/acre x 0.1 = 0.4 AF/acre (130,340 gpy/acre)

Plumbing Code Savings: NA

Plumbing Code NRR: NA

Annual Decay Rate: NA

Useful Life: 1 year

Peak Period Savings Percent: 100%

Unit Sewer Savings: 0

Unit Electricity Savings: NA

Unit Gas Savings: NA

Confidence Score: 3

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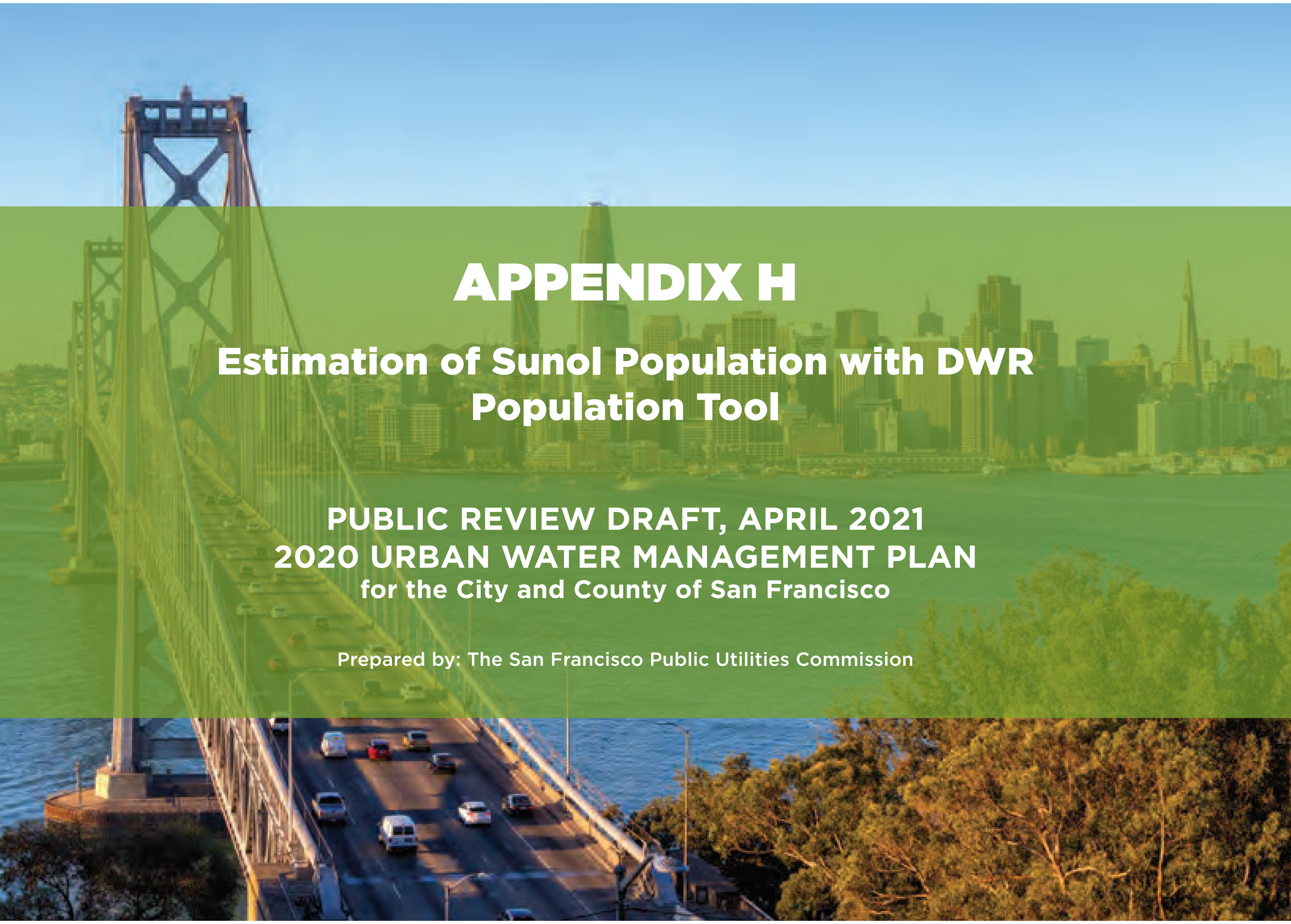

APPENDIX H

Estimation of Sunol Population with DWR Population Tool

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

SFPUC 2020 UWMP Update

Population Estimate for the Town of Sunol

Appendix H

The DWR Population Tool was used in the development of the 2015 UWMP in order to estimate the population of the Town of Sunol, one of SFPUC's suburban retail customer. However, the results from the Population Tool in 2015 showed that the linear interpolation process of the tool was underestimating the population of the area. The Population Tool (see Population Tool results below) showed that estimated a 1.08 persons-per-connection in 2015, which is not representative of the area, based on the historical persons-per-connection of 4.75 in 2000 and of 2.30 in 2010. Based on SFPUC's understanding of the local population density, SFPUC consulted with DWR and it was determined that the 2010 persons-per-connection value could be applied to estimate the 2015 population.

For the 2020 UWMP, SFPUC sought guidance from DWR staff and since the local population density in the Town of Sunol has not changed significantly since 2015, DWR informed SFPUC that the use of the 2010 persons-per-connection value, previously used in the 2015 UWMP, was appropriate the 2020 UWMP. The 2010 persons-per-connection value is therefore applied to the updated 2020 number of connections to estimate the population for the Town of Sunol, for the calculation of the 2020 per capita water use target.
The 2020 population estimate is therefore 141 * 2.30 = 324.

This appendix includes the email correspondence with DWR about the 2020 UWMP and the results of the Population Tool analysis obtained during the preparation of the 2015 UWMP.

Gmail

Lara Egbeola-Martial <lara@srtconsultants.com>

Population Tool Estimates

Huff, Gwen@DWR <Gwen.Huff@water.ca.gov>
To: "lara@srtconsultants.com" <lara@srtconsultants.com>
Cc: "Ekstrom, Julia@DWR" <Julia.Ekstrom@water.ca.gov>

Mon, Dec 14, 2020 at 12:21 PM

Lara -

Yes, you may modify the persons per connection for the current year based on local knowledge of the population.

In the UWMP, please describe the modifications made and a justification for the change.

Feel free to contact me if you have additional questions.

Sincerely,

Gwen

Gwen Huff
Retired Annuitant - Senior Environmental Scientist (Specialist)
gwen.huff@water.ca.gov
(916) 873-5923

From: Lara Egbeola-Martial <lara@srtconsultants.com>
Sent: Friday, December 11, 2020 2:33 PM
To: DWR Water Use Efficiency <wue@water.ca.gov>
Cc: Triolo, Sarah <STriolo@sfwater.org>; Lisa Pezzino <lisa@srtconsultants.com>
Subject: UWMP Update Question - Population Tool Estimates

Hi WUE Team,

My team and I at SRT Consultants are currently supporting the San Francisco Public Utilities Commission (SFPUC) with the update of their 2020 UWMP.
I attended the training session about the Population Tool on Tuesday this week and wanted to ask a case-specific question regarding the use of the tool.
The Population Tool facilitates the estimation of the population for SFPUC's suburban retail customers that are located in the Town of Sunol. However, for the 2015 UWMP, the results from the Population Tool showed that the linear interpolation process of the tool was underestimating the population of the area (see document attached - with a historical persons-per-connection of 4.75 in 2000 and of 2.30 in 2010, the results showed an estimate of 1.08 persons-per-connection for 2015, which is not representative of the area).
In 2015, SFPUC consulted with DWR staff, and it was determined that the 2010 persons-per-connection value could be applied to estimate the 2015 population, considering the fact that the local population density had not changed much since 2010.

We are now in a similar situation for the 2020 UWMP. It is my understanding that with the same input data, the population estimates results from the tool for year 2020 are likely to underestimate the population again. Since SFPUC expects that the local population density in the Town of Sunol has not changed significantly since 2015, we are considering using the same persons-per-connection used in the 2015 Plan (based on the 2010 estimate) and apply it to the updated 2020 number of connections to determine the population. We were hoping to get your feedback on this approach to estimate the population of a specific subset of SFPUC's retail customers for Chapter 5.

Thank you for your guidance,

Best,

--
Lara Egbeola-Martial, P.E.
SRT Consultants
Water Resources Engineers
415-231-5766 office
510-356-8236 mobile
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www.linkedin.com/company/srt-consultants

WUEdata - San Francisco City And County

Sign Out

Please print this page to a PDF and include as part of your UWMP submittal.

Confirmation Information

Generated By	Water Supplier Name	Confirmation #	Generated On
Winola Cheong	San Francisco City And County	8639310538	1/19/2016 9:11:45 PM

Boundary Information

Census Year	Boundary Filename	Internal Boundary ID
1990	Sunol_11Jan2016.kml	457
2000	Sunol_11Jan2016.kml	457
2010	Sunol_11Jan2016.kml	457

Baseline Period Ranges

10 to 15-year baseline period

2008 total water deliveries[1]: **425311** **Hundred Cubic Feet (CCF)** ▼

2008 total volume of delivered recycled water[1]: **0** **Hundred Cubic Feet (CCF)**

2008 recycled water as a percent of total deliveries: **0.00%**

Number of years in baseline period[2]: **10**

Year beginning baseline period range: **2001** ▼

Year ending baseline period range[3]: **2010**

5-year baseline period

Year beginning baseline period range: **2006** ▼

Year ending baseline period range[4]: **2010**

---

[1] The selected units of measure must apply to both the 2008 total water deliveries and the 2008 total volume of delivered recycled water. If the water supplier records use different units of measure for these volumes, the user must make a conversion so that both volumes are in the same units of measure.

[2] If the 2008 recycled water percent is less than 10 percent, then the first baseline period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first baseline period is a continuous 10- to 15-year period.

[3] The ending year must be between December 31, 2004 and December 31, 2010.

[4] The ending year must be between December 31, 2007 and December 31, 2010.

Persons per Connection

Year	Census Block Level Total Population	Number of Connections *	Persons per Connection
1990	**198**	**69**	**2.87**
1991	-	-	3.06
1992	-	-	3.25
1993	-	-	3.43
1994	-	-	3.62
1995	-	-	3.81
1996	-	-	4.00
1997	-	-	4.19
1998	-	-	4.37
1999	-	-	4.56
2000	**328**	**69**	**4.75**
2001	-	-	4.50
2002	-	-	4.26
2003	-	-	4.01
2004	-	-	3.77
2005	-	-	3.52
2006	-	-	3.28
2007	-	-	3.04
2008	-	-	2.79
2009	-	-	2.54
2010	**237**	**103**	**2.30**
2015	**-**	**-**	**1.08**

** Number of Connections may be either All Residential Connections (Single Family and Multi-Family combined) or All Service Connections. This will depend on the data available from the water supplier's records, but must remain consistent throughout the table.*

Population Using Persons-Per-Connection

Year		Number of Connections *	Persons per Connection	Total Population
10 to 15 Year Baseline Population Calculations				
Year 1	2001	**63**	4.50	**284**
Year 2	2002	**67**	4.26	**285**
Year 3	2003	**71**	4.01	**285**
Year 4	2004	**75**	3.77	**283**
Year 5	2005	**79**	3.52	**278**
Year 6	2006	**83**	3.28	**272**
Year 7	2007	**89**	3.04	**270**
Year 8	2008	**93**	2.79	**259**
Year 9	2009	**94**	2.54	**239**
Year 10	2010	103	2.30	**237**
5 Year Baseline Population Calculations				
Year 1	2006	**83**	3.28	**272**
Year 2	2007	**89**	3.04	**270**
Year 3	2008	**93**	2.79	**259**
Year 4	2009	**94**	2.54	**239**
Year 5	2010	103	2.30	**237**
2015 Compliance Year Population Calculations				
2015		**112**	1.08	**121**

** Number of Connections may be either All Residential Connections (Single Family and Multi-Family combined) or All Service Connections. This will depend on the data available from the water supplier's records, but must remain consistent throughout the table.*

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APPENDIX I

Energy Intensity Analysis

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Urban Water Supplier: *San Francisco Public Utilities Commission*

Water Delivery Product (If delivering more than one type of product use Table O-1C)

Other

Table O-1B: Recommended Energy Reporting - Total Utility Approach

Enter Start Date for Reporting Period	7/1/2019	**Urban Water Supplier Operational Control**		
End Date	6/29/2020			
Is upstream embedded in the values reported?	☑	**Sum of All Water Management Processes**	**Non-Consequential Hydropower**	
Water Volume Units Used	*AF*	Total Utility	Hydropower	Net Utility
Volume of Water Entering Process (volume unit)		*227510*	*0*	*227510*
Energy Consumed (kWh)		*-1242727477*	*0*	*-1242727477*
Energy Intensity (kWh/volume)		*-5462.3*	*0.0*	*-5462.3*

Quantity of Self-Generated Renewable Energy

kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

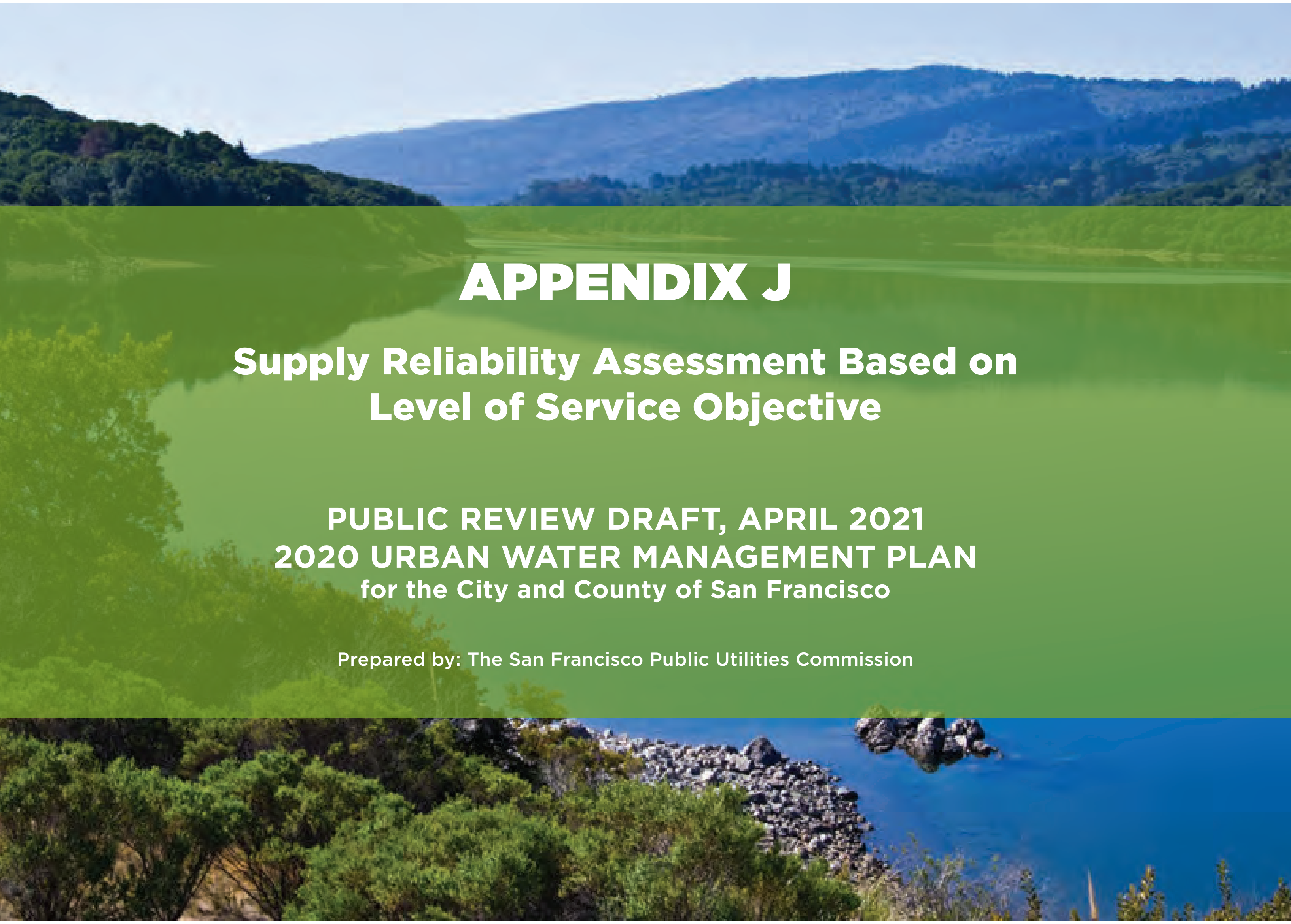
Metered Data

Data Quality Narrative:

The data reported covers FY2019-2020 (July 2019 to June 2020). The water production metering data includes the water supplied by the Regional Water System (RWS) to both retail and wholesale customers. The electricity usage data is based on billing records from meter data. The consequential hydroelectricity production data is based on metered data at the respective hydroelectric power houses. The energy intensity calculation focuses on water supplied by the RWS, since it is the main source of water supplied by SPFUC. While the total volume of water delivered includes both retail and wholesale usage, SFPUC does not have access to electricity meter records for the electricity usage of its wholesale customers to distribute water within their own service areas, and is therefore not included in this analysis. In addition, the electricity consumed by other entities to produce recycled water is not included.

Narrative:

Based on the water delivery system, it is not possible to separate the energy data based on the different water products delivered by SFPUC; retail and wholesale data is therefore reported using the "Total Utility Approach" according to the data available. The energy consumed includes the consequential hydropower produced as a result of the water delivery. The Regional Water System (RWS) is almost entirely gravity-driven from its Sierra Reservoir to the Bay Area; no electricity is used for pumping at wholesale customer turnouts. Electricity usage taken into account in this analysis primarily represents pumping to off-stream storage in the Bay Area, in-city pumping for water distribution, and usage at the SFPUC's two water treatment plants (Sunol and Harry Tracy WTPs). The electricity usage also includes administrative and support facilities. The Hetch Hetchy Regional Power System is composed of three (3) hydroelectric powerhouses, which account of a total hydroelectric generating capacity of 385 MW: Moccasin Powerhouse, Kirkwood Powerhouse and Holm Powerhouse.



APPENDIX J

Supply Reliability Assessment Based on Level of Service Objective

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

The SFPUC has a Level of Service objective to provide an annual average of 265 mgd in normal years, as well as a contractual obligation to provide 184 mgd to the Wholesale Customers in accordance with the Supply Assurance. In addition to the supply modeling presented in the main body of this UWMP, supply modeling was conducted to assess the SFPUC's ability to meet its Level of Service objective and contractual obligations.

As discussed in Section 7.1 of the UWMP, deliveries from the Regional Water System (RWS) to both retail and wholesale customers are limited to an average annual of 265 mgd for the watersheds. Current and projected supply available from the RWS is presented in Table J-1.

Table J-1. Regional Water System Supply Availability in Normal Years (mgd)

RWS Supply Allocation	Actual	Projected				
	2020	2025	2030	2035	2040	2045
Retail Customers[a, b]	81	81	81	81	81	81
Wholesale Customers[c, d]	184	184	184	184	184	184
Total RWS Supplies	265	265	265	265	265	265

a Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.

b Groveland CSD is reported as a wholesale customer for the purposes of this 2020 UWMP, but it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Its demands would be met by the retail supply allocation of 81 mgd.

c Projected Wholesale Customer deliveries are limited to 184 mgd. 184 mgd includes the demands of the Cities of San Jose and Santa Clara, which are supplied on a temporary and interruptible basis, with their total supply not exceeding 9 mgd assuming supply is available (decision to be made by end of 2028).

d Cordilleras MWC is not a party to the WSA, and it is not included in the wholesale supply allocation of 184 mgd. The demands of Cordilleras MWC are minor (projected to be less than 0.01 mgd) and are anticipated to be met with RWS supplies through 2045.

Supply modeling to assess whether SFPUC can meet its Level of Service objective of providing an annual average of 265 mgd in normal years, with no greater than 20% rationing in extended droughts, was conducted using the same methodology described in Section 8.2. The level of demand assumed for the HHLSM model was 265 mgd. For RWS supplies, supply modeling both with and without the implementation of the Bay-Delta Plan Amendment is included here. The two modeled scenarios show significantly different supply reliability projections for the RWS:

- With Full Implementation of the Bay-Delta Plan Amendment: Under the Bay-Delta Plan Amendment conditions, it is anticipated that the RWS supplies will experience a reduction of up to 55% through the multiple dry-year sequence. The implementation of the Alternative Water Supply Program and associated potential projects will help reduce the anticipated supply shortfalls.
- Without Implementation of the Bay-Delta Plan Amendment: In this scenario, the SFPUC system can expect to experience RWS supply reductions of at least 10% to 20% in a sequence of multiple dry years. Implementation of WSIP dry-year supply projects (see Section 7.1.2) will improve the SFPUC's water supply reliability, particularly in the earlier years of the design drought. However, in extended drought periods, the SFPUC will continue to experience multiple years of 10% to 20% reductions in RWS supply.

The supply modeling results are compared to retail demand projections and Wholesale Customer contractual obligations in Table J-3 through J-6 below.

Table J-2. Water Supply Availability During Normal and Dry Years – With and Without Bay-Delta Plan Amendment

Water Supply	Normal Year[a]	Single Dry Year	Multiple Dry Years				
			Year 1	Year 2	Year 3	Year 4	Year 5
Projected Years 2025 through 2045 (post-WSIP completion) – **With** Bay-Delta Plan Amendment							
RWS[b]	100%	50%	50%	45%	45%	45%	45%
Local Groundwater[c]	100%	100%	100%	100%	100%	100%	100%
Local Recycled Water[c]	100%	100%	100%	100%	100%	100%	100%
Projected Years 2025 through 2045 (post-WSIP completion) – **Without** Bay-Delta Plan Amendment							
RWS[b]	100%	90%	90%	90%	90%	80%	80%
Local Groundwater[c]	100%	100%	100%	100%	100%	100%	100%
Local Recycled Water[c]	100%	100%	100%	100%	100%	100%	100%

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability.

[a] For RWS, normal year is defined relative to Table J-1 above, in which 265 mgd of RWS supply is available.

[b] RWS supplies are available to meet both retail and wholesale demands.

[c] Local supplies are available only to meet retail demands.

Table J-3. Retail Supply and Demand Comparison for Projected Normal and Dry Year Scenarios, With Bay-Delta Plan Amendment

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years				
				Year 1[a]	Year 2[b]	Year 3[b]	Year 4 [b]	Year 5 [b]
2025	Total Retail Demand	70.7	70.7	70.7	70.7	70.7	70.7	70.7
	Baseline Retail Demand[c]	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	84.5	53.2	53.2	48.2	48.2	48.2	48.2
	Retail Groundwater[e]	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
	Retail Recycled Water[f]	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
	RWS Supply Available to Retail[g]	*81.0*	*49.7*	*49.7*	*44.7*	*44.7*	*44.7*	*44.7*
	Difference (Supply Surplus or Shortfall)	13.8	-17.5	-17.5	-22.5	-22.5	-22.5	-22.5
	Difference as Percentage of Demand	19.5%	-24.8%	-24.8%	-31.8%	-31.8%	-31.8%	-31.8%
2030	Total Retail Demand	72.4	72.4	72.4	72.4	72.4	72.4	72.4
	Baseline Retail Demand[c]	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	87.9	56.6	56.6	51.6	51.6	51.6	51.6
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*49.7*	*49.7*	*44.7*	*44.7*	*44.7*	*44.7*
	Difference (Supply Surplus or Shortfall)	15.5	-15.8	-15.8	-20.8	-20.8	-20.8	-20.8
	Difference as Percentage of Demand	21.4%	-21.8%	-21.8%	-28.7%	-28.7%	-28.7%	-28.7%
2035	Total Retail Demand	74	74	74	74	74	74	74

	Baseline Retail Demand[c]	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	87.9	56.6	56.6	51.6	51.6	51.6	51.6
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*49.7*	*49.7*	*44.7*	*44.7*	*44.7*	*44.7*
	Difference (Supply Surplus or Shortfall)	13.5	-17.8	-17.8	-22.8	-22.8	-22.8	-22.8
	Difference as Percentage of Demand	18.1%	-23.9%	-23.9%	-30.6%	-30.6%	-30.6%	-30.6%
2040	Total Retail Demand	77.3	77.3	77.3	77.3	77.3	77.3	77.3
	Baseline Retail Demand[c]	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	87.9	56.6	56.6	51.6	51.6	51.6	51.6
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*49.7*	*49.7*	*44.7*	*44.7*	*44.7*	*44.7*
	Difference (Supply Surplus or Shortfall)	10.6	-20.7	-20.7	-25.7	-25.7	-25.7	-25.7
	Difference as Percentage of Demand	13.7%	-26.8%	-26.8%	-33.2%	-33.2%	-33.2%	-33.2%
2045	Total Retail Demand	80.6	80.6	80.6	80.6	80.6	80.6	80.6
	Baseline Retail Demand[c]	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
	Total Retail Supply	87.9	56.6	56.6	51.6	51.6	51.6	51.6
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*49.7*	*49.7*	*44.7*	*44.7*	*44.7*	*44.7*
	Difference (Supply Surplus or Shortfall)	7.3	-24.0	-24.0	-29.0	-29.0	-29.0	-29.0
	Difference as Percentage of Demand	9.1%	-29.8%	-29.8%	-36.0%	-36.0%	-36.0%	-36.0%

Normal, single dry, and multiple dry year conditions are on a water year basis.

[a] During a single dry year and multiple dry year 1, a system-wide shortage of 50% is in effect. For this analysis, a 50% shortage is considered equivalent to the maximum Stage 4, 16-20% system-wide shortage. Under the WSAP, the retail supply allocation at this stage of shortage is 36.0% of available RWS supply, or 49.7 mgd.

[b] During multiple dry years 2 to 5, a system-wide shortage of 55% is in effect. For this analysis, a 55% shortage is considered equivalent to the maximum Stage 4, 16-20% system-wide shortage. Under the WSAP, the retail supply allocation at this stage of shortage is 37.5% of available RWS supply, or 44.7 mgd.

[c] Total retail demands correspond to those in Table 4-1, and reflect active conservation, onsite water reuse savings as well as water loss. Demands for Groveland CSD is included in the table above. However, in the corresponding standardized tables in Appendix B, Groveland CSD is accounted for as a wholesale customer instead of a retail customer, as explained in Section 2.4.

[d] As amended in 2018, the WSAP Tier One Allocation Plan requires retail customers to conserve a minimum of 5% during droughts. If retail demands on the Regional Water System are lower than the retail allocation in a dry year, retail demands on the RWS will be reduced by 5%. An N/A on this row means that either this 5% rationing requirement doesn't apply, or retail customers are already rationing greater than 5%.

[e] Groundwater supplies are assumed to be equivalent to projected demands for the San Francisco Groundwater Supply Project (4.0 mgd by 2030) and Castlewood CSA (0.4 mgd). Groundwater availability would not be affected by dry year conditions.

[f] Recycled water supplies are assumed to be equivalent to projected demands related to the Westside Recycled Water Project (1.6 mgd by 2021 and 1.8 mgd by 2030), Harding Park and Fleming Golf Courses (0.23 mgd), and Sharp Park Golf Course (up to 0.1 mgd) and Treasure Island (0.2 mgd by 2025 and 0.4 mgd by 2030). Recycled water availability would not be affected by dry year conditions.

[g] Procedures for RWS allocations and the WSAP are described in Section 8.3. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, in normal years, if groundwater and recycled water supplies are not available, up to 81 mgd of RWS supply could be used.

Table J-4. Retail Supply and Demand Comparison for Projected Normal and Dry Year Scenarios, Without Bay-Delta Plan Amendment

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years				
				Year 1[a]	Year 2[b]	Year 3[b]	Year 4 [b]	Year 5 [b]
2025	Total Retail Demand	70.7	67.2	67.2	67.2	67.2	67.2	67.2
	Baseline Retail Demand[c]	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*	*70.7*
	WSA 5% Demand Reduction Requirement[d]	*N/A*	*-3.5*	*-3.5*	*-3.5*	*-3.5*	*-3.5*	*-3.5*
	Total Retail Supply	84.5	84.5	84.5	84.5	84.5	83.0	83.0
	Retail Groundwater[e]	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*	*1.4*
	Retail Recycled Water[f]	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*	*2.1*
	RWS Supply Available to Retail[g]	*81.0*	*81.0*	*81.0*	*81.0*	*81.0*	*79.5*	*79.5*
	Difference (Supply Surplus or Shortfall)	13.8	17.3	17.3	17.3	17.3	15.8	15.8
	Difference as Percentage of Demand	19.5%	25.8%	25.8%	25.8%	25.8%	23.6%	23.6%
2030	Total Retail Demand	72.4	68.8	68.8	68.8	68.8	68.8	68.8
	Baseline Retail Demand[c]	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*	*72.4*
	WSA 5% Demand Reduction Requirement[d]	*0*	*-3.6*	*-3.6*	*-3.6*	*-3.6*	*-3.6*	*-3.6*
	Total Retail Supply	87.9	87.9	87.9	87.9	87.9	86.4	86.4
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*81.0*	*81.0*	*81.0*	*81.0*	*79.5*	*79.5*
	Difference (Supply Surplus or Shortfall)	15.5	19.1	19.1	19.1	19.1	17.6	17.6
	Difference as Percentage of Demand	21.4%	27.8%	27.8%	27.8%	27.8%	25.6%	25.6%
2035	Total Retail Demand	74	71	71	71	71	71	71
	Baseline Retail Demand[c]	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*	*74.4*
	WSA 5% Demand Reduction Requirement[d]	*0*	*-3.7*	*-3.7*	*-3.7*	*-3.7*	*-3.7*	*-3.7*
	Total Retail Supply	87.9	87.9	87.9	87.9	87.9	86.4	86.4
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*81.0*	*81.0*	*81.0*	*81.0*	*79.5*	*79.5*
	Difference (Supply Surplus or Shortfall)	13.5	17.2	17.2	17.2	17.2	15.7	15.7
	Difference as Percentage of Demand	18.1%	24.4%	24.4%	24.4%	24.4%	22.2%	22.2%
2040	Total Retail Demand	77.3	73.4	73.4	73.4	73.4	73.4	73.4
	Baseline Retail Demand[c]	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*	*77.3*
	WSA 5% Demand Reduction Requirement[d]	*0*	*-3.9*	*-3.9*	*-3.9*	*-3.9*	*-3.9*	*-3.9*
	Total Retail Supply	87.9	87.9	87.9	87.9	87.9	86.4	86.4
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*81.0*	*81.0*	*81.0*	*81.0*	*79.5*	*79.5*
	Difference (Supply Surplus or Shortfall)	10.6	14.5	14.5	14.5	14.5	13.0	13.0
	Difference as Percentage of Demand	13.7%	19.7%	19.7%	19.7%	19.7%	17.7%	17.7%

2045	Total Retail Demand	80.6	76.6	76.6	76.6	76.6	76.6	76.6
	Baseline Retail Demand[c]	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*	*80.6*
	WSA 5% Demand Reduction Requirement[d]	*0*	*-4.0*	*-4.0*	*-4.0*	*-4.0*	*-4.0*	*-4.0*
	Total Retail Supply	87.9	87.9	87.9	87.9	87.9	86.4	86.4
	Retail Groundwater[e]	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*	*4.4*
	Retail Recycled Water[f]	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
	RWS Supply Available to Retail[g]	*81.0*	*81.0*	*81.0*	*81.0*	*81.0*	*79.5*	*79.5*
	Difference (Supply Surplus or Shortfall)	7.3	11.3	11.3	11.3	11.3	9.8	9.8
	Difference as Percentage of Demand	9.1%	14.8%	14.8%	14.8%	14.8%	12.8%	12.8%

Normal, single dry, and multiple dry year conditions are on a water year basis.

[a] During a single dry year and multiple dry years 1 to 3, a system-wide shortage of 10% is in effect. Under the WSAP, the retail supply allocation at this stage of shortage is 36.0% of available RWS supply, or 85.9 mgd. However, due to the Phased WSIP Variant, only 81 mgd of RWS supply can be delivered.

[b] During multiple dry years 4 and 5, a system-wide shortage of 20% is in effect. Under the WSAP, the retail supply allocation at this stage of shortage is 37.5% of available RWS supply, or 79.5 mgd. RWS supply is capped at this amount.

[c] Total retail demands correspond to those in Table 4-1, and reflect active conservation, onsite water reuse savings as well as water loss. Demands from Groveland CSD are included in the table above. However, in the corresponding standardized tables in Appendix B, Groveland CSD is accounted for as a wholesale customer instead of a retail customer, as explained in Section 2.4.

[d] As amended in 2018, the WSAP Tier One Allocation Plan requires retail customers to conserve a minimum of 5% during droughts. If retail demands on the Regional Water System are lower than the retail allocation in a dry year, retail demands on the RWS will be reduced by 5%. An N/A on this row means that either this 5% rationing requirement doesn't apply, or retail customers are already rationing greater than 5%.

[e] Groundwater supplies are assumed to be equivalent to projected demands for the San Francisco Groundwater Supply Project (4.0 mgd by 2030) and Castlewood CSA (0.4 mgd). Groundwater availability would not be affected by dry year conditions.

[f] Recycled water supplies are assumed to be equivalent to projected demands related to the Westside Recycled Water Project (1.6 mgd by 2021 and 1.8 mgd by 2030), Harding Park and Fleming Golf Courses (0.23 mgd), and Sharp Park Golf Course (up to 0.1 mgd) and Treasure Island (0.2 mgd by 2025 and 0.4 mgd by 2030). Recycled water availability would not be affected by dry year conditions.

[g] Procedures for RWS allocations and the WSAP are described in Section 8.3. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if groundwater and recycled water supplies are not available, up to 81 mgd of RWS supply could be used.

Table J-5. Wholesale Supply and Demand Comparison for Projected Normal and Dry Year Scenarios with Bay-Delta Plan Amendment (mgd)

Year	Wholesale Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years [a]				
				Year 1	Year 2	Year 3	Year 4	Year 5
2025	Total Wholesale Demand[b]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[c]	184.0	82.8	82.8	74.5	74.5	74.5	74.5
	Difference (Surplus or Shortfall)	-0.0	-101.2	-101.2	-109.5	-109.5	-109.5	-109.5
	Difference as % of Demand	0.0%	-55.0%	-55.0%	-59.5%	-59.5%	-59.5%	-59.5%
2030	Total Wholesale Demand[b]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[c]	184.0	82.8	82.8	74.5	74.5	74.5	74.5
	Difference (Surplus or Shortfall)	-0.0	-101.2	-101.2	-109.5	-109.5	-109.5	-109.5
	Difference as % of Demand	0.0%	-55.0%	-55.0%	-59.5%	-59.5%	-59.5%	-59.5%
2035	Total Wholesale Demand[b]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[c]	184.0	82.8	82.8	74.5	74.5	74.5	74.5
	Difference (Surplus or Shortfall)	-0.0	-101.2	-101.2	-109.5	-109.5	-109.5	-109.5
	Difference as % of Demand	0.0%	-55.0%	-55.0%	-59.5%	-59.5%	-59.5%	-59.5%
2040	Total Wholesale Demand[b]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[c]	184.0	82.8	82.8	74.5	74.5	74.5	74.5
	Difference (Surplus or Shortfall)	-0.0	-101.2	-101.2	-109.5	-109.5	-109.5	-109.5
	Difference as % of Demand	0.0%	-55.0%	-55.0%	-59.5%	-59.5%	-59.5%	-59.5%
2045	Total Wholesale Demand[b]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[c]	184.0	82.8	82.8	74.5	74.5	74.5	74.5
	Difference (Surplus or Shortfall)	-0.0	-101.2	-101.2	-109.5	-109.5	-109.5	-109.5
	Difference as % of Demand	0.0%	-55.0%	-55.0%	-59.5%	-59.5%	-59.5%	-59.5%

Normal, single dry, and multiple dry year conditions are on a water year basis.

Groveland CSD is not accounted for as a wholesale customer for the purpose of this table.

[a] The WSA does not define a percentage split above a 20% shortage level. The same split as a 20% shortage level is assumed, and the Wholesale Customers are therefore allocated 62.5%.

[b] Total wholesale demands correspond to those in Error! Reference source not found.. It is assumed that projected Wholesale Customer demands are limited to the Supply Assurance of 184 mgd. The 184 mgd assumes that San Jose and Santa Clara remain temporary, interruptible customers.

[c] Procedures for RWS allocations and the WSAP are described in Section 8.3.

Table J-6. Wholesale Supply and Demand Comparison for Projected Normal and Dry Year Scenarios Without Bay Delta Plan (mgd)

Year	Wholesale Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years				
				Year 1[a]	Year 2[a]	Year 3[a]	Year 4[b]	Year 5[b]
2025	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	157.5	157.5	157.5	157.5	132.5	132.5
	Difference (Surplus or Shortfall)	-0.0	-26.5	-26.5	-26.5	-26.5	-51.5	-51.5
	Difference as % of Demand	0.0%	-14.4%	-14.4%	-14.4%	-14.4%	-28.0%	-28.0%
2030	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	157.5	157.5	157.5	157.5	132.5	132.5
	Difference (Surplus or Shortfall)	-0.0	-26.5	-26.5	-26.5	-26.5	-51.5	-51.5
	Difference as % of Demand	0.0%	-14.4%	-14.4%	-14.4%	-14.4%	-28.0%	-28.0%
2035	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	157.5	157.5	157.5	157.5	132.5	132.5
	Difference (Surplus or Shortfall)	-0.0	-26.5	-26.5	-26.5	-26.5	-51.5	-51.5
	Difference as % of Demand	0.0%	-14.4%	-14.4%	-14.4%	-14.4%	-28.0%	-28.0%
2040	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	157.5	157.5	157.5	157.5	132.5	132.5
	Difference (Surplus or Shortfall)	-0.0	-26.5	-26.5	-26.5	-26.5	-51.5	-51.5
	Difference as % of Demand	0.0%	-14.4%	-14.4%	-14.4%	-14.4%	-28.0%	-28.0%
2045	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	157.5	157.5	157.5	157.5	132.5	132.5
	Difference (Surplus or Shortfall)	-0.0	-26.5	-26.5	-26.5	-26.5	-51.5	-51.5
	Difference as % of Demand	0.0%	-14.4%	-14.4%	-14.4%	-14.4%	-28.0%	-28.0%

Normal, single dry, and multiple dry year conditions are on a water year basis.

Groveland CSD is not accounted for as a wholesale customer for the purpose of this table.

[a] Single dry year and multiple dry years 1 to 3 reflect a system-wide shortage of 10%. Under the WSAP, the wholesale supply allocation at this stage of shortage is 64.0% of available RWS supply, or 152.6 mgd. Retail allocation is 36%, or 85.9 mgd; retail allocations above 81 mgd are re-allocated to Wholesale Customers, per the 2018 WSA. 4.9 mgd is added to the wholesale allocation, bringing it to 157.5 mgd.

[b] Multiple dry years 4 and 5 reflect a system-wide shortage of 20%. Under the WSAP, wholesale supply allocation at this stage of shortage is 62.5% of available RWS supply, or 132.5 mgd.

[c] Total wholesale demands correspond to those in Error! Reference source not found.. It is assumed that projected Wholesale Customer demands are limited to the Supply Assurance of 184 mgd. The 184 mgd assumes that San Jose and Santa Clara remain temporary, interruptible customers.

[d] Procedures for RWS allocations and the WSAP are described in Section 8.3.

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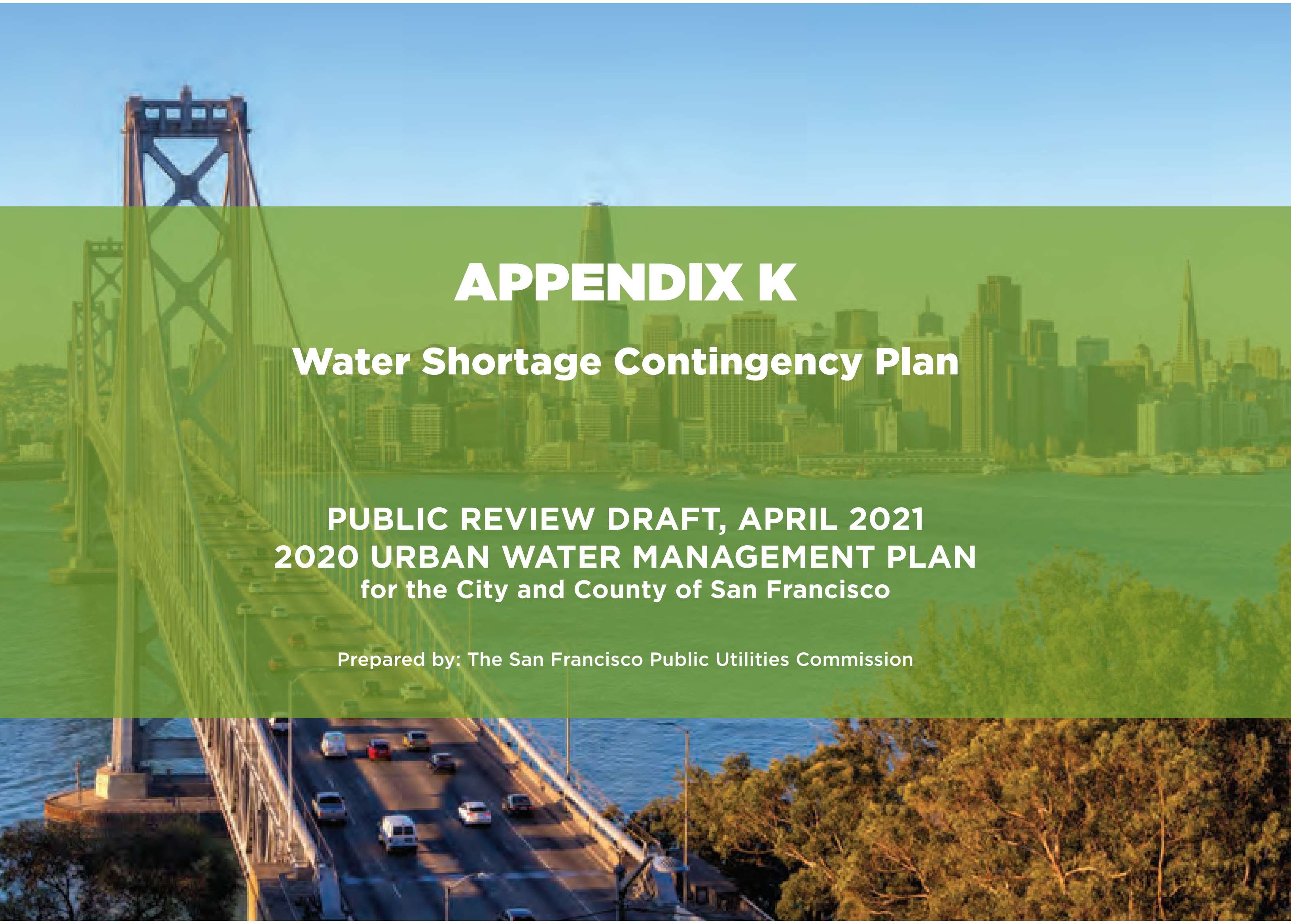


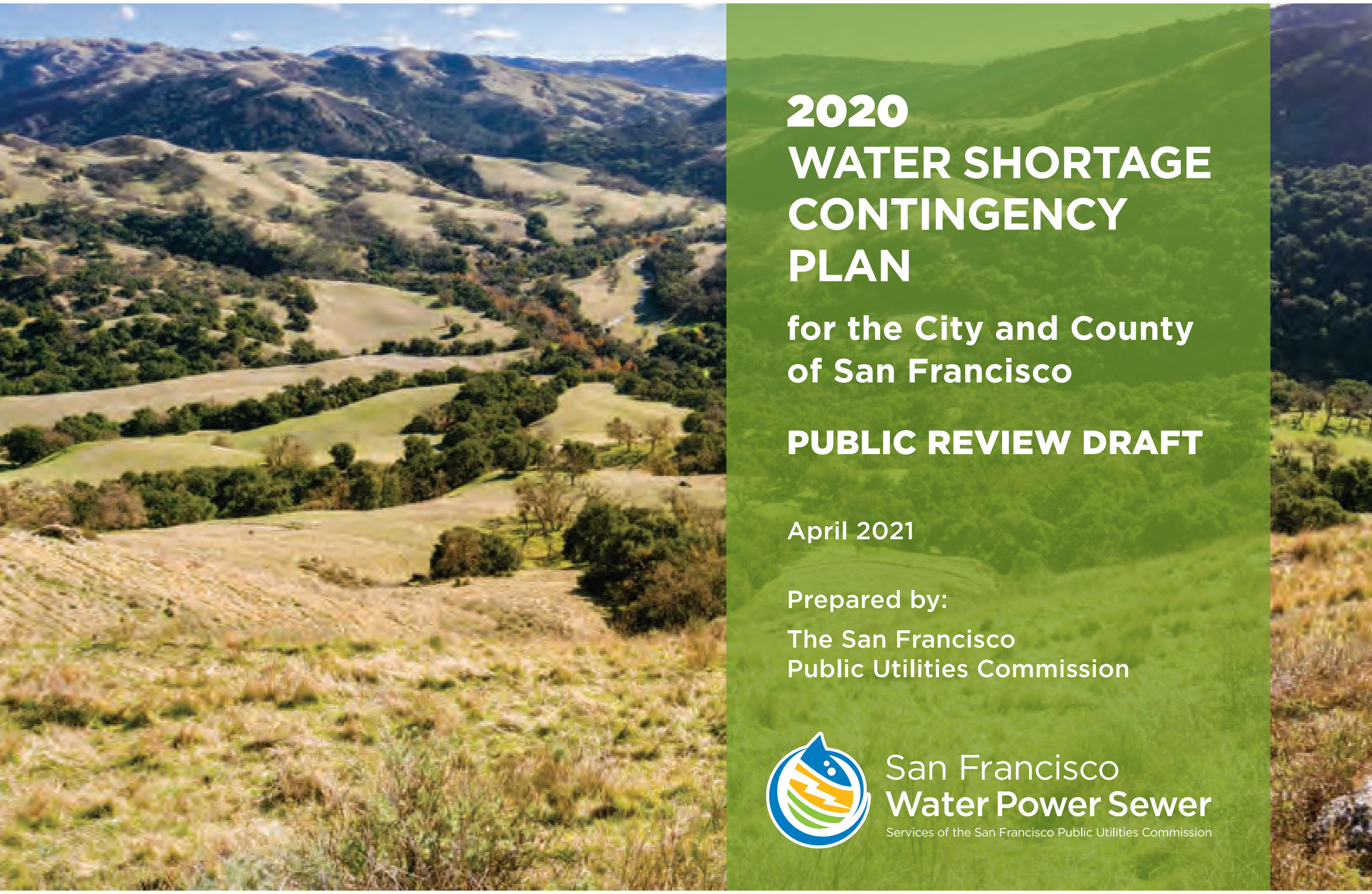
APPENDIX K

Water Shortage Contingency Plan

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission



2020
WATER SHORTAGE CONTINGENCY PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

April 2021

Prepared by:

The San Francisco
Public Utilities Commission

San Francisco
Water Power Sewer
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TABLE OF CONTENTS

APPENDICES

Appendix A	Water Shortage Allocation Plan (Attachment H of Water Supply Agreement Between the City and County of San Francisco and with Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County)
Appendix B	Summary of San Francisco's Response to 1987-92 Drought Experience
Appendix C	Summary of San Francisco's Response to 2012-2016 Drought Experience
Appendix D	San Francisco Public Utilities Commission Resolution Adopting 2020 Water Shortage Contingency Plan

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AF	acre-feet (volume of water, equivalent to 325,851 gallons)
ASO	airborne snow observatory
AWIA	2018 America's Water Infrastructure Act
BAWSCA	Bay Area Water Supply and Conservation Agency
CCF	hundred cubic feet (volume of water, equivalent to 748 gallons)
City	City and County of San Francisco
CWC	California Water Code
DEOP	Division Emergency Operations Plan
DMM	Demand Management Measure
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EDRP	Emergency Disinfection and Recovery Plan
EOP	Emergency Operations Plan
ERAP	Emergency Response Action Plan
ERP	Emergency Response Plan
ERRP	Emergency Response and Recovery Plan
GPCD	gallons per capita per day
Groveland CSD	Groveland Community Services District
HTWTP	Harry Tracy Water Treatment Plant
ISL	Interim Supply Limitation
LOS	levels of service
MG	million gallons
mgd	million gallons per day (flow or usage rate of water)
RWS	San Francisco Regional Water System,
RWSAP	Retail Water Shortage Allocation Plan
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
State	State of California
SVWTP	Sunol Valley Water Treatment Plant
SWRCB	State Water Resources Control Board
UWMP	Urban Water Management Plan
WPCP	water pollution control plant
WSA	Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County
WSAP	Water Shortage Allocation Plan
WSCP	Water Shortage Contingency Plan
WSDA	Water Supply and Demand Assessment
WSIP	Water System Improvement Program

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SECTION 1 INTRODUCTION

The San Francisco Public Utilities Commission (SFPUC) is pleased to present this Water Shortage Contingency Plan (WSCP or Plan) for the City and County of San Francisco (City).

The City owns and operates the San Francisco Regional Water System (RWS), a public asset that plays a key role in delivering high-quality drinking water to more than 2.7 million residents and businesses in the San Francisco Bay Area. The system collects water from the Tuolumne River in the Sierra Nevada and from protected local watersheds in the East Bay and Peninsula.

The SFPUC operates the RWS to deliver water to 27 wholesale customers in Alameda, Santa Clara, and San Mateo Counties, as well as the Groveland Community Services District (Groveland CSD) in Tuolumne County. The Bay Area Water Supply and Conservation Agency (BAWSCA) represents the interests of 26 of the wholesale customers in Alameda, Santa Clara, and San Mateo Counties (collectively, Wholesale Customers) and coordinates their water conservation programming. The SFPUC also provides retail water service to customers in San Francisco (generally referred to as in-City retail customers) and a small number of customers outside of San Francisco that are located along the RWS transmission system (generally referred to as suburban retail customers). Additionally, some retail customers are supplied with local groundwater and recycled water supplies. The SFPUC also has a robust retail conservation program, as well as an Onsite Water Reuse program to reduce water demands and use water more efficiently.

This WSCP presents the latest information about the SFPUC's annual water supply and demand assessment (WSDA) procedures and describes the SFPUC's water shortage contingency planning. This WSCP coincides with additional planning efforts conducted by the SFPUC, including its urban water management planning.

This introduction section provides background on the SFPUC's response to past water shortage experiences pre-2010 (Section 1.1, described in more detail in Appendix B) as well as the most recent 2012-2016 drought (Section 1.2, described in more detail in Appendix C).

1.1 EXPERIENCE WITH WATER SHORTAGES PRE-2010

Every water system has vulnerabilities in terms of its ability to provide a safe and reliable supply of water. Water shortages can occur in a number of ways. Very localized shortages can occur due to distribution system problems, and system shortages can occur due to major facility failures. Apart from system facility contingencies, potential drought periods may limit the amount of water that is available over a series of years. Drought contingency planning is not necessarily caused by physical facility limitations. Within the past 30 years, San Francisco has experienced both localized shortages due to earthquakes and system-wide shortages due to drought.

The SFPUC's past experiences with water shortages during drought and following major earthquakes have shaped its current water shortage preparedness plans and response policies:

- In 1987-92 San Francisco experienced a serious drought. During 6-year drought the SFPUC adopted various levels of action in response to the main Hetch Hetchy source of water available to the SFPUC being taxed to the point of running out of water.

- Following the October 17, 1989 Loma Prieta earthquake, the SFPUC worked with the Mayor's Office of Emergency Response to reconnect water service to retail customers impacted by the earthquake. Most of the homes that lost water service were reconnected within 72 hours.

- In April 2007, below normal precipitation and snow pack caused the SFPUC to initiate a 10% voluntary reduction in water use in the service area. The call for a voluntary reduction continued through 2009.

The 1987-92 drought illustrated the deficit between the SFPUC's supplies and its customers' demands. Other than the 1976-77 drought, drought sequences in the past did not seriously affect the ability of the SFPUC to maintain full deliveries to its customers. As the SFPUC progressed into the 1987-92 drought and reservoir storage continued to decline, it became evident that full deliveries could not be sustained without the risk of running out of water before the drought ended. This circumstance became a reality in early 1991 when the Hetch Hetchy Reservoir became so depleted (less than 25,000 AF of storage in a reservoir with over 360,000 AF of capacity) that minimum instream flow releases and anticipated demands required the SFPUC to initiate programs to achieve a 45% reduction in system-wide water deliveries to balance water supplies with deliveries. Fortunately, unexpected runoff in March 1991 provided relief from the severity of that instance of water shortage; however, the drought was far from over.

Appendix B provides a more detailed summary of San Francisco's 1987-92 drought experience and the actions taken at the time.

1.2 EXPERIENCE WITH THE 2012-2016 DROUGHT

From 2012-2016, California experienced a severe drought which included the driest four consecutive water years based on statewide precipitation (2012-2015) and the lowest April 1 statewide snowpack water equivalent (5 percent in 2015). The unprecedented dry weather conditions prompted then-Governor Jerry Brown to declare a drought State of Emergency in January 2014, which remained in effect for most of California until 2017. The SFPUC took the following actions in response to the drought:

- **Voluntary call for water use reduction:** Spurred by the declaration of a State of Emergency in January 2014, the SFPUC requested that all customers of the RWS voluntarily reduce water use by at least 10 percent. Soon after, the San Francisco Mayor's Office issued a formal executive directive requiring all City departments to develop individual water conservation plans and take immediate steps to achieve a mandatory 10 percent reduction in water consumption. Ultimately, no water shortage emergency was declared, and no subsequent mandatory system-wide rationing and shortage allocations were imposed because customers exceeded the 10 percent voluntary system-wide reduction in conjunction with the Statewide mandatory reductions assigned by the State Water Resources Control Board (SWRCB) (see below). The SFPUC lifted the call for a voluntary 10 percent reduction in April 2017.
- **Statewide mandatory reductions:** In July 2014, new emergency conservation regulations issued by the SWRCB prompted the SFPUC to implement outdoor water waste restrictions and require a mandatory 10 percent reduction in outdoor water use. Additional emergency conservation regulations issued by the SWRCB in the spring of 2015 established more Statewide water use restrictions, a mandatory Statewide water reduction of 25 percent compared to 2013 water use, and conservation standards for individual urban water suppliers to meet the Statewide 25 percent reduction. These emergency conservation regulations were the first of their kind, indicative of the State's desire for swift and substantial action to cope with the drought. The State's these regulations assigned the SFPUC retail service area a conservation standard of 8 percent in recognition of its low residential per capita water use. In the SFPUC wholesale service area, conservation standards assigned to the Wholesale Customers ranged from 8 percent to 36 percent. The conservation standards took effect in June 2015 and remained in effect through April 2017.
- **Mandatory reduction of outdoor water use:** In addition to the State mandates, the SFPUC imposed a mandatory 10% reduction on outdoor irrigation along with water use allocations and excess use charges for all retail irrigation customers starting in August 2014. Following the additional SWRCB regulations in the spring of 2015, the SFPUC increased the mandatory reduction on retail outdoor irrigation from 10 percent to 25 percent starting in July 2015. The SFPUC lifted the mandatory reduction on outdoor irrigation in July 2016.

Appendix C provides a more detailed overview of San Francisco's response to the 2012-2016 drought.

SECTION 2 ANNUAL WATER SUPPLY AND DEMAND ASSESSMENT PROCEDURES

Each year the SFPUC evaluates the amount of total water storage expected to occur throughout the RWS and compares it to expected demands. This annual Water Supply and Demand Assessment (WSDA) is described in the subsections below, which are organized by the sequential steps the SFPUC takes to conduct the assessment each year and reference the relevant California Water Code requirements for a WSDA.[1]

The SFPUC's annual WSDA is a robust planning system that considers a range of input factors unique to the SFPUC's water supplies and system configuration while also providing the flexibility to consider new factors. Traditional surface water supplies from the SFPUC's up country, East Bay, and Peninsula reservoirs are the backbone of the water supply, but the SFPUC extends and protects those supplies in many additional ways by: (1) partnering with the community to help save water through robust conservation programs; (2) minimizing the need for additional water to serve new developments through an onsite water reuse program; (3) recycling wastewater resources to deliver water for large non-potable uses; (4) utilizing local groundwater supplies to supplement surface water supplies; (5) investigating new, alternative water supply options such as purified water and desalination; and (6) investing in innovations that allow for creative solutions to meet diverse needs. These efforts help the SFPUC conserve water and diversify supplies to reduce likelihood of a water shortage condition.

2.1 DEMAND ASSESSMENT [WATER CODE SECTION 10632(A)(2)(B)(I)]

To calculate unconstrained customer demand for the purpose of an annual WSDA, the SFPUC collects information on both the retail and wholesale system demands. Retail customer demand is estimated based on the best available information to date, and typically includes the previous year's demands as well as consideration of current demand use patterns or other conditions impacting demands, such as weather and growth. Each year, in February, the SFPUC receives from BAWSCA a report of estimated Wholesale Customer demand for the upcoming year. BAWSCA typically estimates unconstrained demands for the Wholesale Customers by using total water purchased by those customers in the prior year along with other relevant information. Relatively small demands from the two additional wholesale customers not part of the WSA are estimated based on the best available information to date, and typically includes the previous year's demands as well as consideration of current demand use patterns or other conditions impacting demands, such as weather and growth.

2.2 SUPPLY ASSESSMENT [WATER CODE SECTIONS 10632(A)(2)(B)(II) AND 10632(A)(2)(B)(V)]

The RWS collects water from the Tuolumne River watershed in the Sierra Nevada and from local reservoirs in the Alameda and Peninsula watersheds. The RWS draws an average of 85 percent of its supply from the Tuolumne River watershed. This water feeds into an aqueduct system delivering water 167 miles by gravity to Bay Area reservoirs and customers. The remaining RWS supply is drawn from local surface waters in the Alameda and Peninsula watersheds. The split between these resources varies from year to year depending on the water year hydrology and operational circumstances.

To project and evaluate water supply conditions, the SFPUC uses measurements of precipitation and snowpack in the watersheds above Hetch Hetchy, Cherry, and Eleanor Reservoirs. Snowpack conditions are evaluated regularly by the Cooperative Snow Survey (conducted by the SFPUC in partnership with state and federal agencies) beginning in late January of each year. The SFPUC also estimates snowpack conditions using information from airborne snow observatory

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[1] California Water Code section 10632(a)(1) requires "*the analysis of water supply reliability conducted pursuant to Section 10635.*" Additional information about the SFPUC's water supply reliability analysis can be found in Chapter 7 of the SFPUC's 2020 UWMP.

(ASO) and other sources. The SFPUC maintains a hydrologic model of the watersheds that uses this information to project expected runoff for the coming year. This process also includes a statistical analysis of additional expected precipitation. In addition to projected runoff, the determination of projected available water supply also takes into account stored water throughout the RWS, water acquired by the SFPUC from non-SFPUC sources, inactive storage, reservoir losses, and allowances for carryover storage.

Additionally, the SFPUC accounts for groundwater provided by the San Francisco Groundwater Supply Project for the in-City retail system and recycled water provided for irrigation at Harding Park, Fleming and Sharp Park Golf Courses.

The RWS relies on precipitation and snowmelt captured and stored in its reservoirs. During droughts, water supply deliveries can exceed inflows, such that water stored in previous years is relied upon to meet demands. Because of the importance of carry-over storage, the SFPUC constantly monitors and evaluates water supply conditions in the RWS. Look-ahead forecasts are updated as a year's hydrology and operations change. Generally, in early winter of any year, SFPUC staff can begin providing a forecast of water supply conditions for the upcoming year based on known and anticipated winter and spring precipitation and snowpack. The predictive power of this forecast improves greatly through the spring. The annual precipitation, snowmelt, and carry-over storage together constitute the SFPUC's reservoir storage condition. Using data for each of these factors, the SFPUC can determine whether the reservoir system will be capable of serving full deliveries to its customers. Section 2.3 describes the system modeling SFPUC conducts.

Table 2-1 shows the availability of RWS supplies for retail customers and Wholesale Customers in normal years. Table 2-2 shows the current and projected RWS supply needs to meet retail and wholesale demands based on information and projections presented in the SFPUC's 2020 UWMP.

The SFPUC sells water to 26 of its 28 wholesale customers under the terms of the 25-year contract known as the Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County (WSA) and associated individual water sales contracts with each Wholesale Customer. The WSA carries forward the SFPUC's "Supply Assurance" of 184 million gallons per day (mgd) to the Wholesale Customers. The SFPUC has agreed to deliver water to the Wholesale Customers up to the amount of the Supply Assurance, and this agreement is perpetual and survives the expiration of the WSA. The Supply Assurance is, however, subject to reduction due to water shortage, drought, scheduled RWS maintenance activities, and emergencies. The WSA also describes the temporary limitation on water sales established by the Phased Water System Improvement Plan (WSIP) in 2008. This "Interim Supply Limitation" (ISL) limits water sales from the RWS to an average annual amount of 265 mgd. The WSA allocations the ISL between the SFPUC's retail customers and Wholesale Customers as follows:

- Wholesale supply allocation: 184 mgd
- Retail supply allocation: 81 mgd[2]

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[2] Groveland CSD is considered a retail customer of the SFPUC. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation of 81 mgd.

Table 2-1. Regional Water System Supply Availability in Normal Years (mgd)

RWS Supply Allocation	Actual	Projected				
	2020	2025	2030	2035	2040	2045
Retail Customers[a, b]	81	81	81	81	81	81
Wholesale Customers[c, d]	184	184	184	184	184	184
Total RWS Supplies	265	265	265	265	265	265

a Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.

b Groveland CSD is reported as a wholesale customer for the purposes of this 2020 UWMP, but it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail and Wholesale Customers. Its demands would be met by the retail supply allocation of 81 mgd.

c Projected Wholesale Customer deliveries are limited to 184 mgd, including the demands of the Cities of San Jose and Santa Clara, which are supplied on a temporary and interruptible basis, with their total supply not exceeding 9 mgd assuming supply is available (decision to be made by end of 2028).

d Cordilleras MWC is not a party to the WSA, and it is not included in the wholesale supply allocation of 184 mgd. The demands of Cordilleras MWC are minor (projected to be less than 0.01 mgd) and are anticipated to be met with RWS supplies through 2045.

Table 2-2. Regional Water System Supply Utilized in Normal Years (mgd)

RWS Supply Allocation	Actual	Projected				
	2020	2025	2030	2035	2040	2045
Retail Customers[a, b]	66.5	67.2	67.5	68.6	70.5	73.7
Wholesale Customers[c, d]	132.1	146.0	147.9	151.9	156.3	162.8
Total RWS Supplies	198.6	213.2	215.4	220.5	226.8	236.5

a Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if these alternative supplies are not available, up to 81 mgd of RWS supply could be used in normal years.

b Groveland CSD is reported as a wholesale customer for the purposes of this 2020 UWMP, but it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail and Wholesale Customers. Its demands would be met by the retail supply allocation of 81 mgd.

c Projected Wholesale Customer deliveries are limited to 184 mgd, including the demands of the Cities of San Jose and Santa Clara, which are supplied on a temporary and interruptible basis, with their total supply not exceeding 9 mgd assuming supply is available (decision to be made by end of 2028).

d Cordilleras MWC is not a party to the WSA, and it is not included in the wholesale supply allocation of 184 mgd. The demands of Cordilleras MWC are minor (projected to be less than 0.01 mgd) and are anticipated to be met with RWS supplies through 2045.

2.3 INFRASTRUCTURE CONSIDERATIONS [WATER CODE SECTION 10632(A)(2)(B)(III)]

On an ongoing basis, the SFPUC’s Hetch Hetchy Water and Power, Water Supply and Treatment Division, and Hydrology and Water Systems group conduct analyses of the RWS that incorporate planned facility outages and multiple levels of projected system demands to evaluate and plan for potential water delivery constraints. These groups meet quarterly to share plans and coordinate how facility outages, changes in service area demand, wet or dry weather, and other variables shape the operating plans each year. Facility outages due to maintenance or upgrades are coordinated in an adaptive manner to respond to changes as they occur. For new water supplies or new capital projects related to supply distribution, impacts on the system are evaluated extensively prior to initiation of any changes. Results from these modeling efforts are considered in the annual WSDA.

2.4 SYSTEM MODELING [WATER CODE SECTION 10632(A)(2)(B)(IV)]

To proactively plan for conditions that would result in a shortage of water supplies, the SFPUC models conditions using a hypothetical drought that is more severe than what the RWS has historically experienced. This drought sequence is referred to as the “design drought” and serves as the basis for planning and modeling of future scenarios. The design drought consists of an 8.5-year sequence of dry conditions.

In applying its water supply planning methodology, the SFPUC performs an initial model simulation of the system for the design drought sequence and then reviews the ability of the system to deliver water to the service area through the entire design drought sequence. If the projected water supply runs out before the end of the design drought sequence in the initial model run, system-wide water supply rationing is added and the scenario is re-run. This process continues iteratively until a model simulation of the system is achieved in which the water supply in storage at the end of the design drought sequence is brought to the system “dead pool,” where no additional storage is available for delivery (currently simulated as 96,775 acre-feet). Drawing system storage down to the dead pool without going below it indicates that water supply delivery, including the adjusted amount of rationing, is maintained through the design drought sequence.

Estimated rationing levels and corresponding storage threshold values can then be used to simulate the operation of the system through the historical record of hydrology, or to evaluate system water supply conditions during an ongoing drought. While the design drought sequence does not occur in the historical hydrology, the rationing and storage threshold values that are adjusted to allow a system configuration to maintain water delivery through the design drought sequence can be used to evaluate system performance in the historical record, or as a comparison for real-time system conditions. Through use of this planning method, the SFPUC can simulate a response to declining water supply in storage that is appropriate for the system conditions being evaluated.

The SFPUC plans its water deliveries using indicators for water supply rationing that are developed through analysis with the design drought sequence. As a result, the SFPUC system operations are designed to provide sufficient carry-over water in SFPUC reservoirs to continue delivering water, although at reduced levels, during multiple-year droughts.

2.5 DECISION-MAKING PROCESS [WATER CODE SECTION 10632(A)(2)(A)]

Regardless of the expectation of shortage conditions, as part of the normal course of business, the SFPUC provides a water supply condition update to its executive team every two weeks throughout the year. The SFPUC also provides water supply estimates to its Wholesale Customers on a monthly basis beginning February 1. A Wholesale Customer Annual Meeting is held in the last week of February at which the SFPUC makes a presentation on current water supply conditions and forecasts. The last snow survey of the season typically occurs within the first week of April, followed by a runoff forecast to determine total system storage expected as of July 1. By the middle of April, the SFPUC sends a formal letter to the Wholesale Customers summarizing the water supply availability for the coming year.

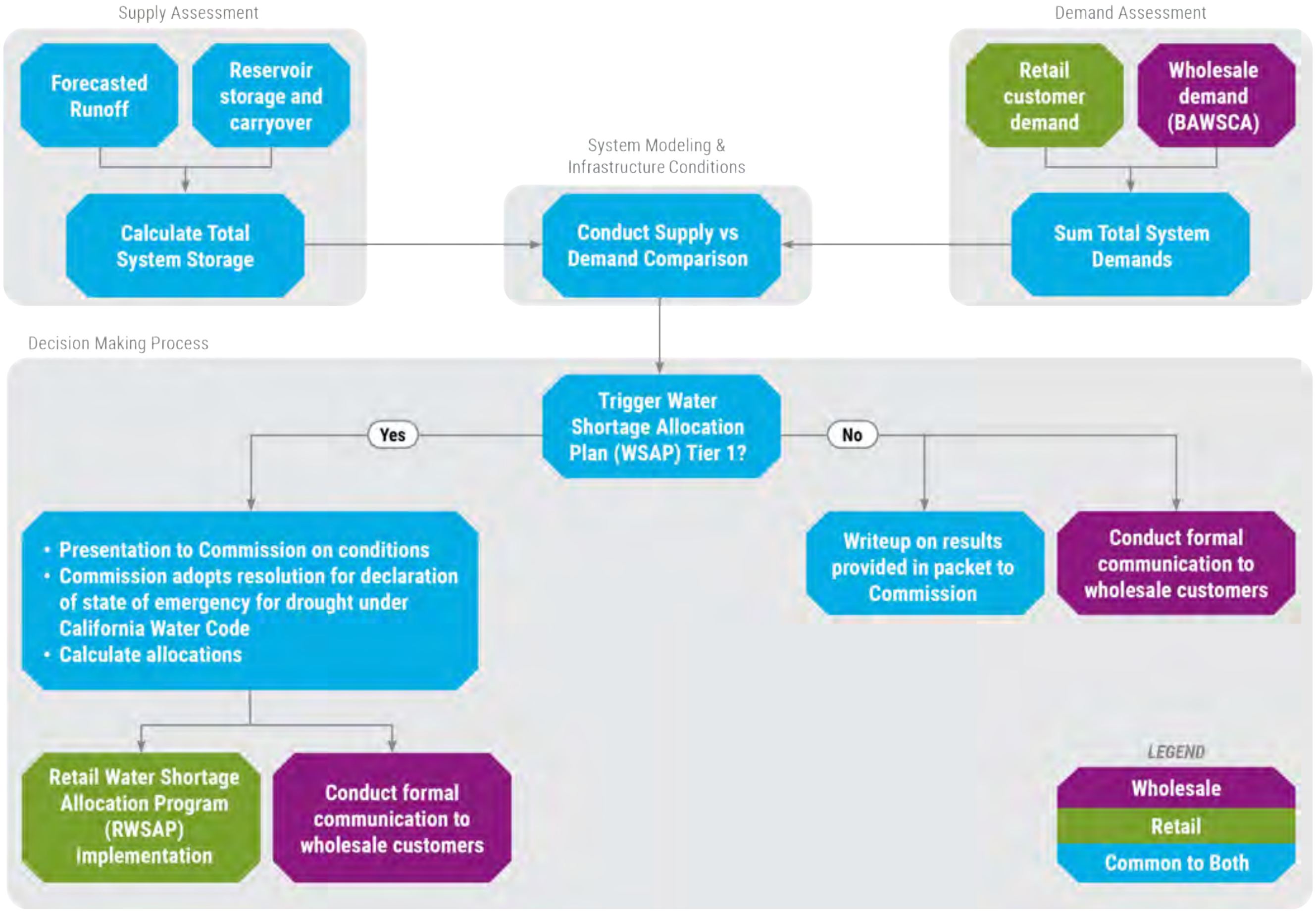
If the RWS appears incapable of meeting system-wide demand due to drought, the SFPUC is expected to declare a water shortage by March 31 of that drought year. The General Manager, or designee, is responsible for declaring such a shortage. A presentation would be made to the Commission as part of the General Manager’s report, showing conditions of precipitation to date, snowpack, and storage levels with more information as necessary depending on the particulars of the supply forecast. Depending on the level of shortage, the Commission may adopt a resolution declaring a water shortage emergency under the California Water Code, or lesser actions such as a call for voluntary conservation efforts.

Prior to the initiation of any water delivery reductions to its retail customers, whether it be initial implementation of delivery reductions or implementing a different water shortage level, the SFPUC will outline a drought response plan to address the following: the water supply situation; proposed water use reduction objectives; alternatives to water use reductions;

methods to calculate water use allocations and adjustments; compliance methodology and enforcement measures; and budget considerations. Details on the expected allocation program are described further in Section 4.1. This drought response plan will be presented at a regularly scheduled SFPUC Commission meeting and advertised in accordance with the requirements of Section 6066 of the California Government Code.

The overall WSDA process is described visually in the flowchart presented in Figure 2-1.

Figure 2-1: Water Supply and Demand Assessment Process



SECTION 3 WATER SHORTAGE LEVELS

The SFPUC has two plans that determine how to allocate RWS supplies in the event of a water shortage condition: (1) the Water Shortage Allocation Plan (WSAP) defines how RWS supplies will be split between the SFPUC's retail customers and the Wholesale Customers collectively (see Section 3.1), and (2) the Retail Water Shortage Allocation Plan (RWSAP) defines how a retail water shortage will be allocated amongst the retail customers (see Section 3.2). The WSAP is also used for allocating the total wholesale supply allocation amongst the respective Wholesale Customers (see Appendix A). These two plans, and their associated water shortage levels, are described further below and in Section 4.1.

3.1 WATER SHORTAGE ALLOCATION PLAN (WSAP) AND ASSOCIATED WATER SHORTAGE LEVELS

The WSAP (see Appendix A) is an attachment to the Water Supply Agreement between the City and the Wholesale Customers described above. The WSAP describes the method for allocating water between the SFPUC's retail customers and the Wholesale Customers collectively during shortages caused by drought. The WSAP applies only when the SFPUC determines that a system-wide water shortage due to drought exists.

The WSAP includes specific allocations of the available water supply between the SFPUC's retail customers and the Wholesale Customers collectively for varying system-wide shortages of up to 20 percent, as shown in Table 3-1. In the event that the retail customer percentage share of the available water supply in Table 3-1 results in retail customers having a positive allocation (i.e., a supply of additional water rather than a required percentage reduction in water use), then the retail customer percentage share of the available water supply would be reduced to eliminate any positive allocation to retail customers, with a corresponding increase in the percentage share of the available water supply allocated to the Wholesale Customers. For any level of required reduction in system-wide water use during shortages, the SFPUC shall require retail customers to conserve a minimum of 5 percent, with any resulting reallocated supply credited to storage for inclusion in calculation of projected available RWS water supply in a subsequent year.

Note that the WSAP does not define allocations between the SFPUC's retail customers and the Wholesale Customers above shortage levels of 20 percent. For the purposes of this WSCP, the SFPUC assumes that the allocations for the 16-20 percent shortage level would apply to all higher shortage levels. In practice, the WSAP defines a process for the SFPUC and the Wholesale Customers to determine whether the application of this allocation to shortage levels greater than 20 percent is appropriate or whether a change is required (for further information about this process, see Appendix A).

The SFPUC's shortage response actions as they relate to the Wholesale Customers are defined in the WSAP (see Appendix A) and are included in this WSCP by reference.

Table 3-1. Retail and Wholesale RWS Allocations during System-wide Shortage

Shortage Level	Required Level of System-wide Reduction in Water Use	SFPUC Retail Share of Available RWS Supply[a]	Collective Wholesale Customers' Share of Available RWS Supply
1	5% or less	35.5%	64.5%
1	6 – 10%	36.0%	64.0%
2	11 – 15%	37.0%	63.0%
2	16 – 20%	37.5%	62.5%
3[b]	Up to 30%	37.5%	62.5%
4[b]	Up to 40%	37.5%	62.5%
5[b]	Up to 50%	37.5%	62.5%
6[b]	>50%	37.5%	62.5%

a While Groveland CSD is reported in the 2020 UWMP as a wholesale customer, it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation.

b Note that the WSAP does not define allocations between the SFPUC's retail customers and the Wholesale Customers above RWS shortage levels of 20%. The WSAP defines a process for the SFPUC and the Wholesale Customers to determine whether the application of the 16-20% allocation to shortage levels greater than 20% is appropriate or whether a change is required.

3.2 RETAIL WATER SHORTAGE LEVELS

The Retail Water Shortage Allocation Plan (RWSAP) (see Section 4.1 below), which pertains to retail customers only, outlines how any retail water shortages, after the application of the WSAP described above, will be allocated among the retail customers. Table 3-2 identifies the water shortage levels on a system-wide basis, and the corresponding retail water shortage condition that would need to be addressed at each shortage level under the RWSAP.

For the purposes of this analysis, system-wide shortages are expressed with respect to a normal year supply, i.e. 265 mgd, as shown above in Table 2-1. System-wide shortages are applied to this baseline supply of 265 mgd; subsequently, the WSAP allocation process described in Section 3.1 is applied to the actual RWS supply that is available to determine the shares of that supply that are available to the retail customers and the Wholesale Customers, respectively. The resulting share of RWS supply available for use by the retail customers, along with the retail groundwater and recycled water supplies that are projected to be available, are compared with the retail customers' demands to determine the level of retail shortage that would result.

The retail water shortage condition under the RWSAP may be different from the system-wide water shortage level. For example, in a 10 percent system-wide shortage of the Regional Water System, SFPUC would receive an allocation of 81 mgd.[3] Given that retail demands are projected to reach only 80.6 in 2045, there would not be an expected retail shortage

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[3] 265 mgd of supply is first reduced by 10%, which results in an available supply of 238.5 mgd. Based on Table 3-1, the SFPUC retail share of available RWS supply is 36.0% under a 10% system-wide shortage: 238.5 mgd * 36.0% = 85.9 mgd. This results in retail customers having a positive allocation (i.e., a supply of additional

under that condition within the planning horizon of 2045. Under the terms of the Water Supply Agreement, as amended and restated in 2018, SFPUC has agreed to require 5 percent conservation in the event of any declared water shortage; thus in this scenario SFPUC would implement a voluntary reduction in water use of 5 percent.

At higher shortage levels, the retail allocation from the RWS results in a retail water shortage that varies depending on the retail demand levels. The ranges specified in Table 3-2 represent the expected water shortage conditions over the planning horizon from 2020 to 2045, over which time retail demands are increasing.

Table 3-2. Retail Water Shortage Levels of Action

[Standardized UWMP Table 8-1: Water Shortage Contingency Plan Levels]

Shortage Level	Required Level of System-wide Reduction in Water Use	Shortage Response Action
1	Up to 10%	Voluntary retail water use reduction of 5%
2	Up to 20%	Voluntary retail water use reduction of 5%
3	Up to 30%	Voluntary retail water use reduction of 5%
4	Up to 40%	Voluntary or mandatory rationing for retail water use reduction of 5% to 18%
5	Up to 50%	Mandatory rationing for retail water use reduction of 18% to 32%
6	>50%	Mandatory rationing for retail water use reduction of >32%

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water rather than a required percentage reduction in water use), thus the retail customer percentage share of the available water supply is reduced to the normal retail supply allocation of 81 mgd to eliminate any positive allocation to retail customers.

SECTION 4 RETAIL WATER SHORTAGE RESPONSE ACTIONS

Once a water shortage has been identified, the SFPUC will implement its Retail Water Shortage Allocation Plan (RWSAP) to allocate available water supplies among the SFPUC's retail customers (see Section 4.1). The SFPUC also maintains several permanent restrictions on retail customer water use as well as potential prohibitions related to water use that may be enforced during a drought (see Section 4.2) and implements several other programs and activities that assist customers with reducing demands (see Section 4.3). The SFPUC may also, depending on the extent of water shortage, implement operational changes (see Section 4.4) or pursue the development of emergency water supplies (see Section 4.5).

4.1 RETAIL WATER SHORTAGE ALLOCATION PLAN (RWSAP)

The RWSAP was initially adopted in 2001 to formalize a program of action to be taken in the retail service area to reduce water use during a drought. This WSCP updates and replaces the standalone RWSAP. The new, updated RWSAP described herein outlines the actions the SFPUC may take in response to a declaration of a water shortage. The actions taken depend on the applicable retail water shortage level, as described in Table 3-2. The declared retail water shortage level determines the total level of retail customer demand reduction that the SFPUC may require. The primary mechanism of the RWSAP is rationing, which begins as a voluntary measure and advances to a mandatory measure in higher retail water shortage levels.

4.1.1 Voluntary vs. Mandatory Rationing

During a declared water shortage emergency, the SFPUC may implement either voluntary or mandatory rationing, depending on the retail water shortage condition. Based on experience in previous droughts, the SFPUC will likely use voluntary calls for rationing if the target retail water use reduction is 10% or less. If the target retail water use reduction is greater than 10%, the SFPUC will likely implement mandatory rationing as described further in the sections below.

4.1.2 Types of Allocation Methods for Mandatory Rationing

In the event of a mandatory rationing program, the SFPUC must adopt a system for allocating water amongst its retail customers. During a water shortage emergency, multiple allocation methods may be needed for different customer types. During the 1987-1992 drought, four allocation methods were considered: (1) the per capita allocation method, (2) the inside/outside or seasonal allocation method, (3) the uniform allocation method, and (4) the percentage allocation method. The following provides a description of each method and the potential advantages or disadvantages of applying each method.

Per capita allocation method. The per capita allocation method, which is only applicable for residential customer types, assigns each residential occupant a fixed daily amount of water. To implement this method, an accurate count of the number of occupants per metered account is required. Currently, customers can self-report this information, and the SFPUC has collected self-reported occupancy data for the majority of residential accounts. The method does not take into account differences in dwelling type, existing landscaping needs, or special individual circumstances. Implementing a per capita allocation is not possible with commercial and industrial customers; those customers would require a different method for determining allocations.

Inside/Outside allocation method. The inside/outside method, also referred to as the seasonal method, applies a percent reduction to both indoor and outdoor use. To determine an individual customer's allocation, a base year of water use is selected and reductions are applied to both inside and outside use. Water use during the winter season is identified as reflecting typical "inside use". The average water use by a customer during the winter months

(November, December, January, February) of the base year is used as the baseline for determining inside use for all 12 months. Water use in excess of the baseline during other months of the year is considered “outside use”. The monthly inside/outside allocation is a sum of the inside use and the outside use reduced by their respective percentages. This method is used to distribute water equitably and in previous decades was proven effective in achieving system-wide consumption goals. However, San Francisco’s residential water use patterns have changed significantly in the last decade, showing very little seasonal use and limited savings to be achieved by focusing on outdoor use only. Additionally, because this method reduces water allocations for all customers regardless of their current use, there is concern that the individual water users who are already consuming very low amounts of water will be affected disproportionately compared to individual water users consuming larger amounts of water.

Uniform allocation method. The uniform allocation method applies a fixed daily amount per dwelling unit for all residential customers. This method does not distribute water equitably to all customers, especially since it does not take into consideration the number of individuals living in each dwelling unit. As with the per capita allocation method, this method could not be applied to commercial and industrial customers.

Percentage allocation method. The percentage allocation method requires water allocation to be based on a straight percent reduction of past use. As an example, to achieve a specified reduction goal, all customers would be allotted a specific percentage of the amount of water that they used in each billing period in the base year. The method requires a much greater reduction in inside use and could cause hardship on both residential and commercial customers.

During the 1987-92 drought, the inside/outside method was implemented because it was found to be the most fair and reasonable method amongst the alternatives. At that time, for those customers that appealed their allocations, a per capita allocation was applied to the account. Since then, SFPUC’s residential water consumption patterns have changed significantly, reflecting less seasonality and less outdoor use overall. The SFPUC has also improved its collection of occupancy data per metered account, allowing use of the per capita method as the preferred allocation method for residential accounts. The preferred allocation method for non-residential accounts (i.e. irrigation-only, commercial, industrial, and municipal) is the percentage allocation method.

4.1.3 Residential Rationing Floor

SFPUC retail customers already have one of the lowest residential per-capita water use rates in California, with an average water use rate of 42 gallons per capita per day (GPCD) in Fiscal Year 2019-2020. In the event that mandatory rationing is instituted during a water shortage emergency, the SFPUC will adopt a minimum per-capita residential allocation, or rationing ”floor” to ensure a sufficient amount of water is available to its customers for basic health and safety needs. The appropriate floor will be determined by the General Manager or designee at the time a water shortage emergency is declared and will be specified in the drought response plan, as further described in Section 5.

4.1.4 Water Shortage Allocation Process

If a water shortage emergency is declared that results in the need for mandatory rationing, the SFPUC will allocate shortages to different customer types in an effort to minimize the economic impacts of mandatory rationing. An example of how shortages may be allocated by customer type is as follows:

1. The SFPUC will apply reductions for *irrigation-only* accounts; different levels of reduction may be required depending on whether the irrigation-only account is a residential, commercial, or municipal account type. Note that customers using recycled water for irrigation will not be required to ration their use of recycled water.

2. If there is still a shortage remaining, the SFPUC will apply reductions to *single-family and multi-family residential* accounts, up to 30% or down to the per capita rationing floor, whichever occurs first
3. If there is still a shortage remaining, the SFPUC will apply reductions to *commercial and industrial* accounts, up to 30%
4. If there is still a shortage remaining, the SFPUC will apply reductions to *municipal and other* accounts, up to 30%.
5. If there is still a shortage remaining, the SFPUC will return to *irrigation-only* accounts and make further reductions, proceeding in same order with additional reductions from each sector.

The SFPUC will inform its retail customers of a water shortage by March 31 of every year in which there is a shortage. If mandatory rationing is being implemented, the SFPUC will determine water allocations for each retail customer account using the allocation method that is determined to be the most appropriate at the time based on the nature of the water shortage and water use trends. If an allocation method is chosen that requires establishment of baseline water use levels, allocations will be based on water use for the last year prior to the drought declaration. The SFPUC will provide water use allocations to all retail customers by May 1 of the drought year. The water use allocations will become effective July 1. Allocations for residential customers will not go below the per capita rationing floor that will be established by the General Manager or designee at the time of declared water shortage emergency.

4.1.5 Appeal Process

On or before May 1, retail customers will be notified of their reduced water allocations. Each retail customer will have the opportunity to appeal the allocation based on increased occupancy, medical exemptions, increased business, or other miscellaneous reasons. The SFPUC will provide retail customers with instructions on how to file appeals at the time the customers are notified of the water use allocations. Customers may be required to submit supplementary information in support of their appeal. The SFPUC will also inform customers of the methodology to be used in modifying allocations if they are granted.

4.2 WATER WASTE PROHIBITIONS

Table 4-1 summarizes potential temporary prohibitions related to water use that the SFPUC may enforce during a drought, as well as permanent restrictions on retail customer water use established in the SFPUC Rules and Regulations Governing Water Service to Customers.[4] Appendix B describes various measures employed during the 1987-92 drought to achieve a 25 percent system-wide reduction in retail demands (as applied to the pre-drought demand). These measures included absolute limitations on water use based on residential customer classification and a proportion of historical use within the non-residential sectors. Appendix C describes various measures employed during the 2012-2016 drought to achieve a primarily voluntary 10 percent system-wide reduction in retail demands.

Note that the SFPUC's implementation of each of the temporary prohibitions is not directly linked to a particular water shortage level under this WSCP. The only water shortage response action that will be implemented specifically in response to a particular shortage level is rationing (either voluntary or mandatory).

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[4] The SFPUC Rules and Regulations Governing Water Service to Customers may be accessed at: https://www.sfpuc.org/sites/default/files/accounts-and-services/RulesRegs-waterservice_11FEB2020.pdf

Table 4-1. Water Use Restrictions and Prohibitions

Permanent[a]
Water waste, including but not limited to, any flooding or runoff into the street, sidewalk or gutter
Using hoses for any purpose without a positive shut-off valve
Serving water at a restaurant, café, or food counter without waiting for a request by a customer or customers
Potable water is not to be used to clean, fill or maintain levels in decorative fountains.
Use of potable water for consolidation of backfill, dust control or other nonessential construction purposes if groundwater or recycled water is available and approved by the San Francisco Department of Public Health[b]
Use of single-pass cooling systems, fountains, and commercial car washes
Use of potable water to wash sidewalks, driveways, plazas and other outdoor hardscapes for reasons other than health, safety, or to meet City of San Francisco standards for sidewalk cleanliness and in a manner that causes runoff to storm drains and sewer catch basins
Watering outdoor landscapes with potable water during and within 48 hours after a rain event
Not providing guests the option to refuse daily laundering of towels and linens at hotels and motels, and not prominently displaying notice of this option in each guestroom
Irrigation with potable water of ornamental turf on public street medians
Temporary (i.e., imposed during water shortage)
Limit the use of additional water for new or retrofitted landscaping or expansion of existing facilities under all conditions not otherwise subject to San Francisco's Water Efficient Irrigation Ordinance. [c]
Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of service[c]
Use of supplies other than groundwater and/or recycled water for irrigation of golf courses, median strips, and similar turf areas[c]
Use of potable water on golf courses outside irrigation of putting greens[c]
Use of potable water for street sweepers/washers[c]
The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains, and airplanes outside of a commercial washing facility; unless required to clean windows on all vehicles and such commercial or safety vehicles for health and safety reasons[c]
The filling of new swimming pools, spas, hot tubs, or the draining and refilling of existing pools, etc.[c]

a Established in SFPUC Rules and Regulations Governing Water Service to Customers, Section E, Rule 12.

b Consistent with the Soil Compaction and Dust Control Ordinance, Ordinance 175-91 (San Francisco Public Works Code, Article 21, Sections 1100-1107).

c Prescribed in the 1987-92 and 2012-16 drought; may be enforced during a future drought.

4.3 DEMAND REDUCTION ACTIONS

The following methods are employed or offered by the SFPUC to help reduce consumption in the retail service area. All of these methods, except for one, are implemented on a continuous basis or as needed, regardless of whether there is a water shortage. Many of these methods are also demand management measures (DMMs) that are currently implemented and described in more detail in the SFPUC's 2020 Urban Water Management Plan (UWMP). Some of these methods may have an increase in application, participation, or frequency as a result of a shortage (e.g., public outreach, rebates, Water Wise Evaluations), but the increase is not necessarily triggered by a specific level of shortage.

- **Expand Public Information Campaign:** Through its conservation program, the SFPUC develops media campaigns and extensive informational materials, and performs widespread outreach activities to (1) inform the public of a drought, (2) relay information about water use reductions and prohibitions, and (3) promote conservation and use of the SFPUC's conservation services. The SFPUC regularly notifies top residential and commercial water users of their consumption and the SFPUC's conservation services to help reduce demands.

- **Improve Customer Billing and Water Use Information:** In conjunction with the deployment of its Automated Water Meter Program, the SFPUC launched a new bill management system and web portal called My Account in May 2014. This system allows customers to view their daily and hourly water use data provided by the automated water meter reading system. The SFPUC also started to implement fractional billing in January 2017 so customers, instead of being billed on a 1 unit (i.e., 1 CCF) basis, are billed for each 0.01 unit (i.e., 1 cubic foot) consumed which provides customers with more detailed feedback on their water use on their monthly bills. The transition of the billing system from bi-monthly to monthly billing for all customers was completed in July 2013.

    - During the 2012-2016 drought, the SFPUC called for 10 percent voluntary reductions and added information and a graph to My Account so residential customers could visually connect with their water use and identify potential reductions.

- **Offer Water Use Surveys:** The SFPUC provides free Water-Wise Evaluations for homes and businesses through its conservation program. These Water-Wise Evaluations consist of an onsite or phone-based review of indoor fixtures and appliances as well as an onsite review of irrigation systems. Each assessment includes a summary report outlining recommendations to improve efficiency as well as estimated water savings. Interest and participation in this service tends to increase during times of drought.

- **Provide Rebates or Giveaways of Plumbing Fixtures and Devices:** Through its conservation program, the SFPUC provides free conservation fixtures and devices to San Francisco residents. Incentive programs may be accelerated during a water shortage. Free devices include showerheads, faucet aerators, toilet leak detection tablets and standard repair parts, flow-measuring bags, soil moisture meters, pre-rinse spray valves, plumbing repair handbooks, and other items.

- **Provide Rebates for Landscape Irrigation Efficiency or Turf Replacement:** The SFPUC's Large Landscape Grant Program offers grants for large landscape irrigation efficiency improvements. Incentive programs may be accelerated during a water shortage.

- **Increase Water Waste Patrols:** SFPUC field inspectors watch for, report, and respond to potential water waste they may encounter as part of their regular travel throughout the City, and the SFPUC also encourages the general public to report potential water waste through the City's 311 service request system, as described in Section 4.2

4.4 OPERATIONAL CHANGES

The following methods are employed or offered by the SFPUC to help reduce water use in the retail service area. These methods, though not formally enacted in the event of a shortage, are employed at the discretion of the SFPUC's operations.

- **Decrease Line Flushing:** Pipeline and other system flushing may be decreased at the discretion of the SFPUC's operations management. Due to the recent drought, the SFPUC temporarily reduced programmatic flushing of dead ends within the in-City distribution system pipelines from a scheduled program to an as-needed basis to respond to water quality issues. Regular system maintenance flushing in the Town of Sunol was also temporarily reduced during the drought to an as-needed basis.

- **Reduce System Water Loss:** The SFPUC conducts pressure management, collects main break data, and administers a Linear Asset Management Program to help control distribution system losses. In addition, to address water loss at the customer level, the SFPUC launched a Leak Alert Program in April 2015 to notify single family residential customers about potential plumbing leaks that may be occurring at their homes. The SFPUC expanded this program to include small multi-family homes (2-5 dwelling units) in September 2018, as well as dedicated irrigation customers in March 2019, and commercial customers in April 2020. The Leak Program will be expanded to all remaining customer sectors in 2021. This program also meets State mandates requiring water suppliers to notify customers when they are aware of leaks that are within the customer's control.

4.5 SUPPLY AUGMENTATION ACTIONS

The SFPUC will use voluntary or mandatory rationing as the primary method to reduce demands during a declared water shortage emergency. Depending on the severity and duration of the water shortage emergency, the SFPUC may also seek to develop emergency water supplies. This could include actions such as initiating water transfers.

4.6 SUMMARY OF RETAIL SHORTAGE RESPONSE ACTIONS

The SFPUC expects to meet water shortages primarily with voluntary and mandatory rationing, and will utilize the RWSAP described above in Section 4.1 to allocate water shortages amongst its retail customers. The SFPUC will also enforce restrictions and prohibitions of certain water uses (as described in Section 4.2) and provide additional programs to facilitate demand reduction (as described in Section 4.3) in order to support meeting its demand reduction targets. The SFPUC may also implement operational changes to reduce water use (as described in Section 4.4). At this time, no supply augmentation shortage response actions have been identified as a specific response to a shortage, but they would be considered (as described in Section 4.5). As described at the beginning of Section 2, the SFPUC already incorporates supply augmentation with dry-year supplies as a part of normal operations and water management planning to reduce the likelihood of a water shortage condition.

Table 4-2 shows the demand reduction actions and volumes of reduction associated with each shortage level described earlier in Table 3-2. For the purposes of this analysis, system-wide shortages are applied to the baseline available supply of 265 mgd; subsequently, the WSAP allocation process described above is applied to the actual RWS supply that is available to determine the shares of that supply that are available to the SFPUC's retail customers and the Wholesale Customers, respectively. The resulting share of RWS supply available for use by the retail customers, along with the retail groundwater and recycled water supplies that are projected to be available, are compared with the retail customer demands to determine the level of retail shortage that would result.

The demand reduction volumes necessary at a given shortage level will change based on the retail demands at the time of a declared water shortage emergency. The volumes associated with shortage response actions shown in Table 4-2 are intended for illustrative purposes, and are based on the projected 2025 levels of retail demand as presented in the SFPUC's 2020 UWMP. As retail demands increase, the associated necessary demand reductions will increase accordingly.

For Shortage Levels 1-3, the SFPUC expects to have enough supply to meet projected unconstrained retail demands. However, as described in Section 3.1 above, the SFPUC has a contractual obligation to require retail customers to conserve a minimum of 5 percent for any level of required reduction in system-wide water use during shortages. A 5 percent reduction in retail demand can be achieved with a voluntary call for reductions in water use. Retail customers collectively conserved more than they were asked to conserve during a 10 percent voluntary system-wide reduction in 2014-2017 during the previous drought. If a retail demand reduction of greater than 10 percent is needed, mandatory rationing will be implemented; in the scenario shown in Table 4-2, that would occur starting at shortage level 4.. Communication actions taken during voluntary and mandatory rationing are described in Section 5.1.

At the higher levels of shortage (i.e. those that would require mandatory rationing) the SFPUC would identify the appropriate allocation methods for different customer types as described in the RWSAP. Table 4-2 shows that the SFPUC could meet the highest level shortage of 21.2 mgd (i.e. shortage level 6) by requiring reductions of 50 percent to irrigation-only accounts, 30 percent reductions in other non-residential accounts, and using a per capita allocation of 25 GPCD for single-family and multi-family residential accounts.

Table 4-2. Shortage Response Actions (Demand Reduction Actions)

[Standardized UWMP Table 8-2: Demand Reduction Actions]

Shortage Level (percent system-wide supply reduction)	Retail Demand Reduction Actions	Associated Volume (mgd)[a]	Additional Explanation or Reference (optional)	Penalty, Charge, or Other Enforcement?
1 (up to 10%)	Voluntary Reduction[b]	3.3	Voluntary call for water use reductions	N
2 (up to 20%)	Voluntary Reduction[b]			N
3 (up to 30%)	Voluntary Reduction[b]			N
4 (up to 40%)	Mandatory Rationing	6.3	Mandatory rationing	Y
5 (up to 50%)	Mandatory Rationing	16.2		Y
6 (>50%)[c]	Mandatory Rationing	21.2		Y

a. Associated volume of reduction is based on 2025 projected unconstrained SFPUC Retail customer demands on the Regional Water System of 65.9 mgd. Volumes shown for each level represent the total shortage that must be met with the associated response action at that shortage level.

b. For Shortage Levels 1-3, the SFPUC expects to have enough supply to meet projected unconstrained retail demands. However, SFPUC has a contractual obligation that for any level of required reduction in system-wide water use during shortages, the SFPUC shall require Retail Customers to conserve a minimum of 5 percent. A 5 percent reduction in retail demand can be achieved with a voluntary call for reductions in water use.

c. The Level 6 shortage (assumed to be 55% system-wide supply reduction) has an associated 21.2 mgd shortage gap in 2025. The demand reductions (methodology described further in Section 4.1) are assumed to ultimately be met with a rationing approach consisting of a 25 gpcd floor for residential accounts, a 50% demand reduction in irrigation accounts, and 30% demand reduction in other non-residential accounts.

SECTION 5 COMMUNICATION PROTOCOLS

Communication with the SFPUC's customers and the public is essential during drought, and particularly so when mandatory actions or restrictions are in effect. Rationing schedules and requirements must be communicated early and often to all customers. The SFPUC will employ multiple methods and means to inform and educate customers and the public.

Prior to the initiation of any water delivery reductions to its retail customers, whether it be initial implementation of delivery reduction or increasing the severity of water shortage response measures, the SFPUC will outline a drought response plan to address the following: the water supply situation; proposed water use reduction objectives; alternatives to water use reductions; methods to calculate water use allocations and adjustments; minimum per capita allocation (i.e. residential rationing floor); compliance methodology and enforcement measures; and budget considerations.

This drought response plan will be presented at a regularly scheduled SFPUC Commission meeting for public input. The meeting will be advertised in accordance with the requirements of Section 6066 of the California Government Code, and the public will be invited to comment on the SFPUC's plan to address reduced supply.

5.1 COMMUNICATIONS ABOUT VOLUNTARY REDUCTIONS

Outreach that may be taken during a call for voluntary reductions include, but are not limited to:

- Milestone press releases and briefings to media
- Social media posts
- Dedicated and regularly updated drought section on sfpuc.org web site
- Articles in the SFPUC's digital and print Currents newsletter to customers
- Bill inserts
- Outdoor billboard, transit station, bus, television, radio and newspaper ads
- Email blasts to stakeholder organizations and groups
- Community presentations
- Direct mail, email, automated call, and mobile text notices
- My Account portal updates to communicate water reduction goals

5.2 COMMUNICATIONS ABOUT MANDATORY RATIONING

Outreach listed in Section 5.1 would likely also occur during mandatory rationing. Additional notifications to account holders that the SFPUC will disseminate under mandatory rationing include:

- Notification letter to all customers prior to activation of mandatory rationing that indicates mandatory water rationing will be implemented, customers are subject to excess use charges, and that a drought surcharge will be levied.

- Notification letter to all customers affected by mandatory reductions that provides their monthly allocations for the fiscal year, including information about the appeals process, availability of daily and hourly consumption data on My Account, and other resources for conservation assistance.

- Notification letter to customers with adjustments to their reduced flow factors, including information about appeals process and resources for conservation assistance.

- End-of-rationing letters that inform all customers that water the water shortage emergency has been lifted and the SFPUC is ending mandatory rationing.

- Noticing for public hearings conducted at SFPUC Commission meetings that inform the Commissioners and public about the declaration of a water shortage emergency and any subsequent modifications to the water shortage stage.

Account holders receive mailed notifications either through the billing service utilized by Customer Service or the City's Reproduction and Mail Services (ReproMail).

5.3 COMMUNICATIONS RELATED TO WHOLESALE CUSTOMERS

Regardless of the expectation of shortage conditions, as part of normal course of business, the SFPUC provides water supply estimates to its Wholesale Customers on a monthly basis beginning February 1. A Wholesale Customer Annual Meeting is held in the last week of February, at which the SFPUC makes a presentation on current water supply conditions and forecasts. The last snow survey of the season typically occurs within the first week of April, followed by a runoff forecast to determine total system storage expected as of July 1. By the middle of April, the SFPUC sends a formal letter to the Wholesale Customers summarizing the water supply availability for the coming year and, if applicable, the declaration of need for a voluntary or mandatory response. A flowchart depicting the annual Water Supply and Demand Assessment process, including communication processes, is shown in Figure 2-1.

SECTION 6 ENFORCEMENT AND PENALTIES

6.1 ENFORCEMENT OF WATER USE ALLOCATIONS

The SFPUC's primary methods of enforcing the water shortage response action of mandatory rationing include excess use charges, installation of flow restrictors on customers' service lines, and/or shut-off of water. In addition, a new state law passed in 2016 (SB 814, adding Chapter 3.3 to Division 1 of the Water Code) requires public disclosure of customers who are fined for exceeding water use allocations.

During the 1987-92 drought, the SFPUC applied drought excess use charges were applied as outlined below. The fines only applied to the amount of water used over their allotment.

- If a customer consumed up to 10% over its allotment, it was charged 2 times the normal rate;
- If a customer consumed 10.01% to 20% over its allotment, it was charged 8 times the normal rate; and
- If a customer consumed 20.01% or over its allotment, it was charged 10 times the normal rate.

During the 2012-2016 drought, the SFPUC called for a 10 percent voluntary reduction in water use by all customers system-wide. However, mandatory reductions and excess use charges were also applied to a small subset of customers:

- Established a mandatory reduction in water use by dedicated irrigation customers of 25%, subject to excess use charges of 1 times the normal rate.

- Established a mandatory reduction in water use by Interruptible Water Service accounts of 30%, subject to excess use charges of 3 times the normal rate.

Under this WSCP, in the event of mandatory rationing, the SFPUC will impose excess use charges at a level deemed appropriate at the time of a declared water shortage emergency. The General Manager, or designee, will inform retail customers of the specific multiplier rates that will be applied for determining excess use charges (as described in Section 5 about Communications). The SFPUC will also offer retail customers an audit at the first run-over of their water use allocation to determine if there are any leaks. In some cases, excess use charges may be reversed if leaks are found and repaired immediately.

In the event that a customer exceeds its water use allocation, the SFPUC may, after issuing one written warning, install a flow restrictor on the customer's service line. The SFPUC may charge the customer a fee for the installation and removal of the flow restrictor, as it did in the 1987-92 drought. The General Manager, or designee, will determine the relevant charge at the time of the drought. If a customer continues to consume water in excess of its allotment, the SFPUC has the authority to discontinue the customer’s water service and require that the customer bear the cost for the re-connection of water service.

The Landlord Pass-through Ordinance[5] allows landlords to pass up to 50 percent of excess use charges on to their tenants under certain conditions.

6.2 ENFORCEMENT OF WATER WASTE PROHIBITIONS

The SFPUC has found customer outreach, communication, and responding to water waste reports submitted through the City’s 311 service request system to be effective methods for enforcing water use prohibitions and restrictions. The SFPUC reviews reports of potential water waste and violation of prohibitions submitted through the 311 system. If a report contains sufficient information and reflects a restricted water use, the SFPUC issues a written notice to the water account holder, property owner, and occupant. If reports of waste continue, the SFPUC will call or visit the site to try to verify that there is waste. If water waste is verified and continues, the SFPUC will issue additional warning letters to the account holder. Account holders that receive multiple warnings of verified water waste may be subject to additional action. The SFPUC also takes the same actions for incidents of water waste observed by SFPUC conservation field inspectors, and the SFPUC may increase the number of and inspectors patrolling for water waste during drought periods.

The water use restrictions and prohibitions may be enforced using the following means:

- Per the SFPUC Rules and Regulations Governing Water Service to Customers and the SFPUC’s water rate schedule, violation of any water use restriction may result in the installation of a flow-restricting device in the service line of the customer, and continued violation could result in termination of service. The customer bears the cost of any enforcement action.

- Per the SFPUC Rules and Regulations Governing Water Service to Customers, violation of water waste prevention for landscaped areas[6] is subject to a written warning, followed by possible termination of service and penalties per Chapter 100 of the San Francisco Administrative Code if the violation is not corrected.

- As part of the SWRCB emergency conservation regulations, the California Water Code was amended to identify violations of water use prohibitions as infractions, and therefore punishable by a fine of up to $500 for each day in which the violation occurs.

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[5] San Francisco Administrative Code Section 37.3

[6] SFPUC Rules and Regulations Governing Water Service to Customers, Section F, Rule 16.

SECTION 7 LEGAL AUTHORITIES

The SFPUC shall declare a water shortage emergency in accordance with California Water Code Chapter 3, Section 350 of Division 1 (general provision regarding water shortage emergencies).

The SFPUC shall coordinate with any city of county within which it provides water supply services for the possible proclamation of a local emergency (California Government Code, California Emergency Services Act Article 2, Section 8558). As described in Section 2.5, the SFPUC is in regular communication with its wholesale customers about water supply conditions.

Additional relevant statutory authorities, local ordinances, and resolutions that provide the legal authorities for implementing the WSCP are listed below:

- Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County (described in more detail in Section 3).
- SFPUC Rules and Regulations Governing Water Service to Customers, established by Resolution No. 19.786 passed December 15, 1959.
- Water Efficient Irrigation Ordinance (City and County of San Francisco Ordinance No. 24-16, approved March 4, 2016).
- Chapter 3.3 of Division 1 of the California Water Code (Excessive Residential Water Use During Drought) requires public disclosure of customers who are fined for exceeding water use allocations.

SECTION 8 FINANCIAL CONSEQUENCES OF WSCP

The SFPUC includes a variable component to water rates for most customer classes. As a result, as sales decrease, revenues are lost on a per unit basis. Because the marginal cost of water production is relatively small, as production is reduced, the cost of service remains the same. Some new costs may be incurred to implement the water shortage action of mandatory rationing, such as the effort required to coordinate implementation of customer-specific allocations in the SFPUC's billing system and the cost of notifying customers (see Section 5.2). For both retail and wholesale customers, a reduction in water purchases – whether voluntary or mandated – would require the SFPUC to raise rates, cut costs, or use existing fund balance reserves to cover its expenses. The financial planning and rate-setting process is complex and iterative. While major impacts of a water shortage on rates are described below, the full process, especially for large water shortages, would incorporate significant stakeholder discussion about tradeoffs and financial impacts.

The SFPUC's current retail water rates have a provision for a "drought surcharge" that automatically increases adopted rates in the event of a declared water shortage. The drought surcharge is calculated so that, accounting for the expected reduction in retail water usage, total revenues are equal to what they would have been without the reduction. The drought surcharge protects the SFPUC's financial stability during water shortages, and provides customers an incentive to meet conservation targets.

For Wholesale Customers, the rate-setting process is governed by the terms of the WSA, which provides that, in the event of a water shortage emergency, the Commission may adjust wholesale rates in an expedited way concurrently with the imposition of drought surcharges on retail customers. Beyond drought rate setting and emergency rate setting, rates are set annually in coordination with the SFPUC annual budget process and are based on the forecasted wholesale share of RWS expenditures and total purchases. If Wholesale Customer usage is expected to decrease – either voluntarily, or due to shortages – this would be incorporated into the wholesale rate forecast, and rates may increase to make up for the revenue loss caused by reductions in water use.

SECTION 9 MONITORING AND REPORTING

Enforcement of the mandatory rationing program is described in more detail above in Section **Error! Reference source not found.**. Actual water savings are tracked through monthly consumption reports that are generated from the customer billing system. These consumption reports are highly accurate as all retail and wholesale customers are metered. Based on a comparison between monthly consumption data, the SFPUC can determine reductions in water use for both retail and wholesale customers. These data will also be used in evaluating the effectiveness of the WSCP (see Section 11). Additional data may be collected on a case-by-case basis. The SFPUC conducts ongoing monitoring of its watersheds, reservoirs, and other components of the RWS for reporting on the status of the water supply for purpose of determining applicability of the water shortage level.

SECTION 10 PREPARATION FOR CATASTROPHIC SUPPLY INTERRUPTION

The SFPUC maintains various planning documents which collectively address its emergency preparedness and planned response in the event of a catastrophic interruption of water supplies due to power outages, earthquakes, or other disasters. These plans are described in sections 10.1 (Emergency Preparedness Plans), 10.2 (Emergency Drinking Water Planning), and 10.3 (Power Outage Preparedness and Response) below. Section 10.4 addresses the seismic risk assessment and mitigation plan required by California Water Code Section 10632.5.(a). Should a catastrophic interruption occur, the SFPUC will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency (California Government Code, California Emergency Services Act Article 2, Section 8558).

10.1 EMERGENCY PREPAREDNESS PLANS

Following the 1989 Loma Prieta Earthquake, the SFPUC created a departmental Emergency Operations Plan (EOP). The SFPUC EOP was originally released in 1992 and has been updated as necessary ever since. Most recently, the SFPUC developed a Water System Emergency Response Plan (Water ERP) to comply with the America's Water Infrastructure Act (AWIA) passed in 2018. The Water ERP acts as a unifying document, integrating and referencing common components of SFPUC plans and programs that have been developed to date. The Water ERP is intended to address water transmission and distribution systems and identify the Enterprises, Divisions, and Bureaus with direct roles and responsibilities. The Water ERP integrates directly into, and functions as an annex to, the SFPUC Emergency Operations Plan (EOP). The SFPUC EOP addresses a broad range of potential emergency situations that may affect the SFPUC and supplements the City's Emergency Response Plan, which was prepared by the Department of Emergency Management and most recently updated in 2017. Specifically, the purpose of the SFPUC EOP is to describe its emergency management organization, roles and responsibilities, and emergency policies and procedures.

In addition, SFPUC divisions and bureaus each have their own Division Emergency Operations Plans (DEOP) (in alignment with the SFPUC EOP), which detail that entity's specific emergency management organization, roles and responsibilities, and emergency policies and procedures. The SFPUC tests its DEOPs on a regular basis by conducting emergency exercises. Through these exercises, the SFPUC learns how well the plans and procedures will or will not work in response to an emergency. DEOP improvements are based on the results of these exercises and real-world event response and evaluation. The SFPUC also has an emergency response training plan that is based on federal, State, and local standards and exercise and incident improvement plans. SFPUC employees have emergency training requirements that are based on their emergency response roles.

The SFPUC EOP functions as a front end for the SFPUC's DEOPs, covering emergency response at the Department level; while each DEOP covers Division-specific information on the Division's emergency organization and response procedures specific to Division responsibilities, assets, technical scope, and operations. The types of events affecting SFPUC that may require emergency plans include but are not limited to:

- Major earthquake
- Loss of power
- Loss of water supply
- Major fire
- Hazardous material release that threatens water supply or environment
- Major pipeline breaks
- Dam break
- Significant outage of SFPUC services
- Man-made or intentional acts of terrorism resulting in damage to the system or interruption in service

In addition to the documents described above, the SFPUC also maintains various plans and procedures that deal with the possibility of alternate supply schemes and options. These include:

- Emergency Disinfection and Recovery Plan (EDRP)
- Emergency Response Action Plan (ERAP)
- Emergency Drinking Water Equipment and Alternatives Report
- Disinfection of SFPUC Water Trailers Procedure
- City Distribution Division Hydrant Manifold Standard Operating Procedure
- Pilot plant trailer (Mobile Pilot Plan O&M Plan)

10.2 EMERGENCY DRINKING WATER PLANNING

In February 2005, the SFPUC published the City Emergency Drinking Water Alternatives report. The purpose of this report was to outline a plan for supplying emergency drinking water in the City after damage and/or contamination of the SFPUC raw and/or treated water systems resulting from a major disaster. Since the publication of this report, the SFPUC has implemented a number of projects to increase its capability to support the provision of emergency drinking water during an emergency. These projects include:

- Completion of many Water System Improvement Program (WSIP) projects and other capital upgrades to improve security, detection, and communication (see Section 10.4);
- Public Information and materials for home and business;
- Construction of a disinfection and fill station at the existing San Francisco Zoo well, and obtaining a permit to utilize this well as a standby emergency drinking water source;

- Constructed six wells as part of the San Francisco Groundwater Supply Project, two of which also serve as emergency drinking water supplies, including a distribution system to fill emergency water tankers;

- Purchase and engineering of emergency-related equipment, including water tanker trucks and water distribution manifolds, to help with distribution post-disaster; and

- Coordination of planning with other City departments, neighboring jurisdictions, and other public and private partners to maximize resources and supplies for emergency response.

The SFPUC has also prepared the RWS Water Quality Notifications and Communications Plan. This plan, which was first prepared in 1996 and was most recently updated in 2017, provides contact information, procedures, and guidelines to be implemented by several SFPUC divisions, wholesale customers, and BAWSCA in the event of water quality impacts. The plan treats water quality issues as potential or actual supply problems, which fall under the emergency response structure of the SFPUC ERP.

10.3 POWER OUTAGE PREPAREDNESS AND RESPONSE

The SFPUC's water transmission system is primarily gravity fed from Hetch Hetchy Reservoir to the City. Within the in-City distribution system, key pump stations have generators on site and all others have connections in place that would allow portable generators to be used.

Although water conveyance throughout the RWS would not be greatly impacted by power outages because it is gravity fed, the SFPUC has prepared for potential regional power outages as follows:

- The Tesla Treatment Facility, the Sunol Valley Water Treatment Plant (SVWTP), and the San Antonio Pump Station have back-up power on site in the form of generators or diesel-powered pumps. Additionally, both the SVWTP and San Antonio Pump Station would not be impacted by a failure of the regional power grid because these facilities are powered by hydropower generated by the Hetch Hetchy Water and Power System.

- Both the Harry Tracy Water Treatment Plant (HTWTP) and the Baden Pump Station (part of the Peninsula System) have back-up generators in place.

- Administrative facilities that will act as emergency operation centers also have back-up power.

- The SFPUC has an emergency water supply connection with the Santa Clara Valley Water District (SCVWD), the SCVWD intertie, which also has back-up generators in place.

- Additionally, as described in the next section, the WSIP includes projects that expand the SFPUC's ability to remain in operation during power outages and other emergency situations.

10.4 SEISMIC RISK ASSESSMENT AND MITIGATION PLAN

As part of the Facilities Reliability Program and the Water System Improvement Program (WSIP), the SFPUC performed an extensive multi-year evaluation of seismic risks to its water system that resulted in major capital improvements to increase seismic reliability. The goals of WSIP include enhancing the ability of the SFPUC water system to meet identified service goals for water quality, seismic reliability, delivery reliability, and water supply. One of the original goals of WSIP was to limit rationing to no more than 20 percent on a system-wide basis; the WSIP was developed to reduce the likelihood of shortages, thereby reducing the likelihood of needing to implement the WSCP.

The WSIP projects include several projects located in San Francisco to improve the seismic reliability of the in-City distribution system, including more wells that can be used as emergency drinking water sources. The WSIP also incorporates many projects related to the RWS to address both seismic reliability and overall system reliability. As of August 2018, the WSIP is over 96 percent complete. Local San Francisco projects are 100 percent complete as of June 2020. The current forecasted date to complete the overall WSIP is December 2021.

WSIP seismic levels of service (LOS) informed development of capital projects and guided program implementation. The LOS established post-earthquake delivery and recovery objectives under the following seismic scenarios:

- Magnitude 7.9 event on the San Andreas fault
- Magnitude 7.3 event on the Hayward fault
- Magnitude 6.9 event on the Calaveras fault

An assessment of seismic risk and resilience is contained in the body of analysis performed to support the WSIP. The risks associated with the seismic scenarios considered are reflected in the delivery objectives established in the LOS, specifically:

- Delivery of winter month demand 24 hours after a major earthquake, and
- Delivery of average day demand 30 days after a major earthquake

In addition to the improvements that have or will come from the WSIP, the City has already constructed system interties for use during catastrophic emergencies, short-term facility maintenance and upgrade activities, and times of water shortages. These are listed below:

- A 35 mgd intertie with the EBMUD allowing EBMUD to serve the City of Hayward’s demand and/or supply the SFPUC directly (and vice versa);

- A 40-mgd system intertie between the SFPUC and SCVWD; and,

- One permanent and one temporary intertie to the South Bay Aqueduct, which would enable the SFPUC to receive State Water Project water.

The WSIP also includes projects related to standby power facilities at various locations. These projects provide for standby electrical power at six critical facilities to keep them in operation during power outages and other emergency situations. Permanent engine generators are located at four locations (San Pedro Valve Lot, Millbrae Facility, Alameda West, and HTWTP), while hookups for portable engine generators are at two locations (San Antonio Reservoir and Calaveras Reservoir).The City of San Francisco also has a Hazard Mitigation Plan which was last updated in June 2014 and includes sections describing earthquakes hazards and mitigation for assets within the City’s boundary, including state-regulated reservoirs (Sutro, Sunset North and South, and University Mound North and South).

SECTION 11 WSCP REFINEMENT PROCEDURES

The SFPUC considers the WSCP a dynamic tool that will be subject to regular refinement as needed to ensure shortage response actions are effective and produce the desired results. If planned shortage response actions are implemented in the future, the SFPUC will conduct an evaluation of their effectiveness using the monitoring and reporting described in Section 9 and incorporate edits as needed to the WSCP.

SECTION 12 PLAN ADOPTION, SUBMITTAL, AND AVAILABILITY

The SFPUC prepared this 2020 WSCP and presented it to the SFPUC Commission for adoption on <DATE>. A copy of the SFPUC resolution adopting this 2020 WSCP is provided in Appendix D.

Within 30 days of SFPUC Commission approval, the adopted 2020 WSCP will be submitted electronically to the DWR via its Water Use Efficiency data online submittal tool (WUEdata). Electronic copies will also be provided on compact disc to the California State Library and via e-mail (within 60 days of WSCP submittal to DWR) to cities and counties within which the SFPUC provides water supplies. In addition, the SFPUC will make this adopted 2020 WSCP available for public review within 30 days of SFPUC Commission approval during normal business hours by placing a copy at the San Francisco Main Public Library and main offices of the SFPUC, as well as by posting an electronic copy on the SFPUC web site at www.sfpuc.org.

Should amendments to the WSCP be required in future years, it is expected that the same adoption, submittal, and availability processes described above would be followed for the updated WSCP.

2020
WATER SHORTAGE CONTINGENCY PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

APPENDICES

April 2021

Prepared by:

The San Francisco
Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

APPENDIX A

Water Shortage Allocation Plan

(Attachment H of Water Supply Agreement Between the City and County of San Francisco and with Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County)

APRIL 2021

WATER SHORTAGE CONTINGENCY PLAN

for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

ATTACHMENT H

WATER SHORTAGE ALLOCATION PLAN

This Interim Water Shortage Allocation Plan ("Plan") describes the method for allocating water between the San Francisco Public Utilities Commission ("SFPUC") and the Wholesale Customers collectively during shortages caused by drought. The Plan implements a method for allocating water among the individual Wholesale Customers which has been adopted by the Wholesale Customers. The Plan includes provisions for transfers, banking, and excess use charges. The Plan applies only when the SFPUC determines that a system-wide water shortage due to drought exists, and all references to "shortages" and "water shortages" are to be so understood. This Plan was adopted pursuant to Section 7.03(a) of the 1984 Settlement Agreement and Master Water Sales Contract and has been updated to correspond to the terminology used in the June 2009 Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County ("Agreement").

SECTION 1. SHORTAGE CONDITIONS

1.1. Projected Available SFPUC Water Supply. The SFPUC shall make an annual determination as to whether or not a shortage condition exists. The determination of projected available water supply shall consider, among other things, stored water, projected runoff, water acquired by the SFPUC from non-SFPUC sources, inactive storage, reservoir losses, allowance for carryover storage, and water bank balances, if any, described in Section 3.

1.2 Projected SFPUC Purchases. The SFPUC will utilize purchase data, including volumes of water purchased by the Wholesale Customers and by Retail Customers (as those terms are used in the Agreement) in the year immediately prior to the drought, along with other available relevant information, as a basis for determining projected system-wide water purchases from the SFPUC for the upcoming year.

1.3. Shortage Conditions. The SFPUC will compare the available water supply (Section 1.1) with projected system-wide water purchases (Section 1.2). A shortage condition exists if the SFPUC determines that the projected available water supply is less than projected system-wide water purchases in the upcoming Supply Year (defined as the period from July 1 through June 30). When a shortage condition exists, SFPUC will determine whether voluntary or mandatory actions will be required to reduce purchases of SFPUC water to required levels.

1.3.1 Voluntary Response. If the SFPUC determines that voluntary actions will be sufficient to accomplish the necessary reduction in water use throughout its service area, the SFPUC and the Wholesale Customers will make good faith efforts to reduce their water purchases to stay within their annual shortage allocations and associated monthly water use budgets. The SFPUC will not impose excess use charges during periods of voluntary rationing, but may suspend the prospective accumulation of water bank credits, or impose a ceiling on further accumulation of bank credits, consistent with Section 3.2.1 of this Plan.

1.3.2 Mandatory Response. If the SFPUC determines that mandatory actions will be required to accomplish the necessary reduction in water use in the SFPUC service area, the SFPUC may implement excess use charges as set forth in Section 4 of this Plan.

1.4. Period of Shortage. A shortage period commences when the SFPUC determines that a water shortage exists, as set forth in a declaration of water shortage emergency issued by the SFPUC pursuant to California Water Code Sections 350 et seq. Termination of the water shortage emergency will be declared by resolution of the SFPUC.

SECTION 2. SHORTAGE ALLOCATIONS

2.1. Annual Allocations between the SFPUC and the Wholesale Customers. The annual water supply available during shortages will be allocated between the SFPUC and the collective Wholesale Customers as follows:

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

The water allocated to the SFPUC shall correspond to the total allocation for all Retail Customers. In the event that the SFPUC share of the available water supply in the above table results in Retail Customers having a positive allocation (i.e., a supply of additional water rather than a required percentage reduction in water use), the SFPUC's percentage share of the available water supply in the table shall be reduced to eliminate any positive allocation to Retail Customers, with a corresponding increase in the percentage share of the available water supply allocated to the Wholesale Customers. For any level of required reduction in system-wide water use during shortages, the SFPUC shall require Retail Customers to conserve a minimum of 5%, with any resulting reallocated supply credited to storage for inclusion in calculation of projected available water SFPUC water supply in a subsequent year (Section 1.1).

The parties agree to reevaluate the percentages of the available water supply allocated to Retail and Wholesale Customers by May 1, 2028.

2.2 Annual Allocations among the Wholesale Customers. The annual water supply allocated to the Wholesale Customers collectively during system wide shortages of 20 percent or less will be apportioned among them based on a methodology adopted by all of the Wholesale Customers, as described in Section 3.11(C) of the Agreement. In any year for which the methodology must be applied, the Bay Area Water Supply and Conservation Agency ("BAWSCA") will calculate each Wholesale Customer's individual percentage share of the amount of water allocated to the Wholesale Customers collectively pursuant to Section 2.1. Following the declaration or reconfirmation of a water shortage emergency by the SFPUC, BAWSCA will deliver to the SFPUC General Manager a list, signed by the President of BAWSCA's Board of Directors and its General Manager, showing each Wholesale Customer together with its percentage share and stating that the list has been prepared in accordance with the methodology adopted by the Wholesale Customers. The SFPUC shall allocate water to each Wholesale Customer, as specified in the list. The shortage allocations so established may be transferred as provided in Section 2.5 of this Plan. If BAWSCA or all Wholesale Customers do not provide the SFPUC with individual allocations, the SFPUC may make a final allocation decision after first meeting and discussing allocations with BAWSCA and the Wholesale Customers.

The methodology adopted by the Wholesale Customers utilizes the rolling average of each individual Wholesale Customer's purchases from the SFPUC during the three immediately preceding Supply Years. The SFPUC agrees to provide BAWSCA by November 1 of each year a list showing the amount of water purchased by each Wholesale Customer during the immediately preceding Supply Year. The list will be prepared using Customer Service Bureau report MGT440 (or comparable official record in use at the time), adjusted as required for any reporting errors or omissions, and will be transmitted by the SFPUC General Manager or his designee.

2.3. Limited Applicability of Plan to System Wide Shortages Greater Than Twenty Percent. The allocations of water between the SFPUC and the Wholesale Customers collectively, provided for in Section 2.1, apply only to shortages of 20 percent or less. The SFPUC and Wholesale Customers recognize the possibility of a drought occurring which could create system-wide shortages greater than 20 percent despite actions taken by the SFPUC aimed at reducing the probability and severity of water shortages in the SFPUC service area. If the SFPUC determines that a system wide water shortage greater than 20 percent exists, the SFPUC and the Wholesale Customers agree to meet within 10 days and discuss whether a change is required to the allocation set forth in Section 2.1 in order to mitigate undue hardships that might otherwise be experienced by individual Wholesale Customers or Retail Customers. Following these discussions, the Tier 1 water allocations set forth in Section 2.1 of this Plan, or a modified version thereof, may be adopted by mutual written consent of the SFPUC and the Wholesale Customers. If the SFPUC and Wholesale Customers meet and cannot agree on an appropriate Tier 1 allocation within 30 days of the SFPUC's determination of water shortage greater than 20 percent, then (1) the provisions of Section 3.11(C) of the Agreement will apply, unless (2) all of the Wholesale Customers direct in writing that a Tier 2 allocation methodology agreed to by them be used to apportion the water to be made available to the Wholesale Customers collectively, in lieu of the provisions of Section 3.11(C).

The provisions of this Plan relating to transfers (in Section 2.5), banking (in Section 3), and excess use charges (in Section 4) shall continue to apply during system-wide shortages greater than 20 percent.

2.4. Monthly Water Budgets. Within 10 days after adopting a declaration of water shortage emergency, the SFPUC will determine the amount of Tier 1 water allocated to the Wholesale Customers collectively pursuant to Section 2.1. The SFPUC General Manager, using the Tier 2 allocation percentages shown on the list delivered by BAWSCA pursuant to Section 2.2, will calculate each Wholesale Customer's individual annual allocation. The SFPUC General Manager, or his designee, will then provide each Wholesale Customer with a proposed schedule of monthly water budgets based on the pattern of monthly water purchases during the Supply Year immediately preceding the declaration of shortage (the "Default Schedule"). Each

Wholesale Customer may, within two weeks of receiving its Default Schedule, provide the SFPUC with an alternative monthly water budget that reschedules its annual Tier 2 shortage allocation over the course of the succeeding Supply Year. If a Wholesale Customer does not deliver an alternative monthly water budget to the SFPUC within two weeks of its receipt of the Default Schedule, then its monthly budget for the ensuing Supply Year shall be the Default Schedule proposed by the SFPUC.

Monthly Wholesale Customer water budgets will be derived from annual Tier 2 allocations for purposes of accounting for excess use. Monthly Wholesale Customer water budgets shall be adjusted during the year to account for transfers of shortage allocation under Section 2.5 and transfers of banked water under Section 3.4.

2.5. Transfers of Shortage Allocations. Voluntary transfers of shortage allocations between the SFPUC and any Wholesale Customers, and between any Wholesale Customers, will be permitted using the same procedure as that for transfers of banked water set forth in Section 3.4. The SFPUC and BAWSCA shall be notified of each transfer. Transfers of shortage allocations shall be deemed to be an emergency transfer and shall become effective on the third business day after notice of the transfer has been delivered to the SFPUC. Transfers of shortage allocations shall be in compliance with Section 3.05 of the Agreement. The transferring parties will meet with the SFPUC, if requested, to discuss any effect the transfer may have on its operations.

SECTION 3. SHORTAGE WATER BANKING

3.1. Water Bank Accounts. The SFPUC shall create a water bank account for itself and each Wholesale Customer during shortages in conjunction with its resale customer billing process. Bank accounts will account for amounts of water that are either saved or used in excess of the shortage allocation for each agency; the accounts are not used for tracking billings and payments. When a shortage period is in effect (as defined in Section 1.4), the following provisions for bank credits, debits, and transfers shall be in force. A statement of bank balance for each Wholesale Customer will be included with the SFPUC's monthly water bills.

3.2. Bank Account Credits. Each month, monthly purchases will be compared to the monthly budget for that month. Any unused shortage allocation by an agency will be credited to that agency's water bank account. Credits will accumulate during the entire shortage period, subject to potential restrictions imposed pursuant to Section 3.2.1. Credits remaining at the end of the shortage period will be zeroed out; no financial or other credit shall be granted for banked water.

3.2.1. Maximum Balances. The SFPUC may suspend the prospective accumulation of credits in all accounts. Alternatively, the SFPUC may impose a ceiling on further accumulation of credits in water bank balances based on a uniform ratio of the bank balance to the annual water allocation. In making a decision to suspend the prospective accumulation of water bank credits, the SFPUC shall consider the available water supply as set forth in Section 1.1 of this Plan and other reasonable, relevant factors.

3.3. Account Debits. Each month, monthly purchases will be compared to the budget for that month. Purchases in excess of monthly budgets will be debited against an agency's water bank account. Bank debits remaining at the end of the fiscal year will be subject to excess use charges (see Section 4).

3.4. Transfers of Banked Water. In addition to the transfers of shortage allocations provided for in Section 2.5, voluntary transfers of banked water will also be permitted between the SFPUC and any Wholesale Customer, and among the Wholesale Customers. The volume of transferred water will be credited to the transferee's water bank account and debited against the transferor's water bank account. The transferring parties must notify the SFPUC and BAWSCA of each transfer in writing (so that adjustments can be made to bank accounts), and will meet with the SFPUC, if requested, to discuss any affect the transfer may have on SFPUC operations. Transfers of banked water shall be deemed to be an emergency transfer and shall become effective on the third business day after notice of the transfer has been delivered to the SFPUC. If the SFPUC incurs extraordinary costs in implementing transfers, it will give written notice to the transferring parties within ten (10) business days after receipt of notice of the transfer. Extraordinary costs means additional costs directly attributable to accommodating transfers and which are not incurred in non-drought years nor simply as a result of the shortage condition itself. Extraordinary costs shall be calculated in accordance with the procedures in the Agreement and shall be subject to the disclosure and auditing requirements in the Agreement. In the case of transfers between Wholesale Customers, such extraordinary costs shall be considered to be expenses chargeable solely to individual Wholesale Customers and shall be borne equally by the parties to the transfer. In the case of transfers between the SFPUC and a Wholesale Customer, the SFPUC's share of any extraordinary transfer costs shall not be added to the Wholesale Revenue Requirement.

3.4.1. Transfer Limitations. The agency transferring banked water will be allowed to transfer no more than the accumulated balance in its bank. Transfers of estimated prospective banked credits and the "overdrafting" of accounts shall not be permitted. The price of transfer water originally derived from the SFPUC system is to be determined by the transferring parties and is not specified herein. Transfers of banked water shall be in compliance with Section 3.05 of the Agreement.

SECTION 4. WHOLESALE EXCESS USE CHARGES

4.1. Amount of Excess Use Charges. Monthly excess use charges shall be determined by the SFPUC at the time of the declared water shortage consistent with the calendar in Section 6 and in accordance with Section 6.03 of the Agreement. The excess use charges will be in the form of multipliers applied to the rate in effect at the time the excess use occurs. The same excess use charge multipliers shall apply to the Wholesale Customers and all Retail Customers. The excess use charge multipliers apply only to the charges for water delivered at the rate in effect at the time the excess use occurred.

4.2 Monitoring Suburban Water Use. During periods of voluntary rationing, water usage greater than a customer's allocation (as determined in Section 2) will be indicated on each SFPUC monthly water bill. During periods of mandatory rationing, monthly and cumulative water usage greater than a Wholesale Customer's shortage allocation and the associated excess use charges will be indicated on each SFPUC monthly water bill.

4.3. Suburban Excess Use Charge Payments. An annual reconciliation will be made of monthly excess use charges according to the calendar in Section 6. Annual excess use charges will be calculated by comparing total annual purchases for each Wholesale Customer with its annual shortage allocation (as adjusted for transfers of shortage allocations and banked water, if any). Excess use charge payments by those Wholesale Customers with net excess use will be paid according to the calendar in Section 6. The SFPUC may dedicate excess use charges paid by Wholesale Customers toward the purchase of water from the State Drought Water Bank or other willing sellers in order to provide additional water to the Wholesale Customers. Excess use charges paid by the Wholesale Customers constitute Wholesale Customer revenue and shall be included within the SFPUC's annual Wholesale Revenue Requirement calculation.

SECTION 5. GENERAL PROVISIONS GOVERNING WATER SHORTAGE ALLOCATION PLAN

5.1. Construction of Terms. This Plan is for the sole benefit of the parties and shall not be construed as granting rights to any person other than the parties or imposing obligations on a party to any person other than another party.

5.2. Governing Law. This Plan is made under and shall be governed by the laws of the State of California.

5.3. Effect on Agreement. This Plan describes the method for allocating water between the SFPUC and the collective Wholesale Customers during system-wide water shortages of 20 percent or less. This Plan also provides for the SFPUC to allocate water among the Wholesale Customers in accordance with directions provided by the Wholesale Customers through BAWSCA under Section 2.2, and to implement a program by which such allocations may be voluntarily transferred among the Wholesale Customers. The provisions of this Plan are intended to implement Section 3.11(C) of the Agreement and do not affect, change or modify any other section, term or condition of the Agreement.

5.4. Inapplicability of Plan to Allocation of SFPUC System Water During Non-Shortage Periods. The SFPUC’s agreement in this Plan to a respective share of SFPUC system water during years of shortage shall not be construed to provide a basis for the allocation of water between the SFPUC and the Wholesale Customers when no water shortage emergency exists.

5.5. Termination. This Plan shall expire at the end of the Term of the Agreement.. The SFPUC and the Wholesale Customers can mutually agree to revise or terminate this Plan prior to that date due to changes in the water delivery capability of the SFPUC system, the acquisition of new water supplies, and other factors affecting the availability of water from the SFPUC system during times of shortage.

SECTION 6. ALLOCATION CALENDAR

6.1. Annual Schedule. The annual schedule for the shortage allocation process is shown below. This schedule may be changed by the SFPUC to facilitate implementation.

6.1.1

In All Years	Target Dates
1. SFPUC delivers list of annual purchases by each Wholesale Customer during the immediately preceding Supply Year	November 1
2. SFPUC meets with the Wholesale Customers and presents water supply forecast for the following Supply Year	February
3. SFPUC issues initial estimate of available water supply	February 1
4. SFPUC announces potential first year of drought (if applicable)	February 1
5. SFPUC and Wholesale Customers meet upon request to exchange information concerning water availability and projected system-wide purchases	February 1-May 31
6. SFPUC issues revised estimate of available water supply, and confirms continued potential shortage conditions, if applicable	March 1
7. SFPUC issues final estimate of available water supply	April 15th or sooner if adequate snow course measurement data is available to form a robust estimate on available water supply for the coming year.
8. SFPUC determines amount of water available to Wholesale Customers collectively	April 15th or sooner if adequate snow course measurement data is available to form a robust estimate on available water supply for the coming year.

In Drought Years	Target Dates
9. SFPUC formally declares the existence of water shortage emergency (or end of water shortage emergency, if applicable) under Water Code Sections 350 et. seq.	April 15-30
10. SFPUC declares the need for a voluntary or mandatory response	April 15-30
11. BAWSCA submits calculation to SFPUC of individual Wholesale Customers' percentage shares of water allocated to Wholesale Customers collectively	April 15- 30
12. SFPUC determines individual shortage allocations, based on BAWSCA's submittal of individual agency percentage shares to SFPUC, and monthly water budgets (Default Schedule)	April 25—May 10
13. Wholesale Customers submit alternative monthly water budgets (optional)	May 8-May 24
14. Final drought shortage allocations are issued for the Supply Year beginning July 1 through June 30	June 1
15. Monthly water budgets become effective	July 1
16. Excess use charges indicated on monthly Suburban bills	August 1 (of the beginning year) through June 30 (of the succeeding year)
17. Excess use charges paid by Wholesale Customers for prior year	August of the succeeding year

APPENDIX B

Summary of San Francisco's Response to 1987-92 Drought Experience

APRIL 2021
WATER SHORTAGE CONTINGENCY PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Summary of San Francisco's Response to 1987-92 Drought Experience

Background:

The 1987-92 six year drought provides an example of how the near-term drought management process works in times when the operational capabilities of Hetch Hetchy and other water supplies available to the SFPUC are taxed to a point that forces drastic actions to avoid running out of water. By the sixth year of that drought period, many of the programs and actions identified in San Francisco's current Retail Water Shortage Allocation Plan (adopted in December 2001) had been implemented. The following describes some of the major actions that occurred.

Demand Reductions:

The extended drought forced San Francisco to adopt a mandatory rationing program, enforced by stiff excess use charges and the threat of shut-off for continued violations of water use prohibitions. Mandatory rationing was in effect May of 1988 through May of 1989, re-instituted in May of 1990, and continued until March of 1993. A Water Shortage Emergency Resolution was passed by the SFPUC on April 28, 1988 declaring these rationing periods (Resolution No. 88-0155). A copy of this resolution can be found at the end of this appendix.

The SFPUC's water rationing program was one of the toughest in the state and the most stringent imposed by any major urban water supply agency. Although the specifics of the program varied over time, the basic outline of the mandatory rationing program was to achieve a 25 percent reduction to 1987 (pre-drought) consumption (system-wide), with water allocations set on an account-by-account basis.

To provide a strong incentive for customers to use no more water than their allotment, the SFPUC adopted a rate structure that incorporated excess use charges. Any customer that used less water than its allotment was charged the normal rate per unit of water consumption, while any customer who used more than its allotment was charged a multiple of the normal rate for every unit of consumption above its allotment. As of January 1, 1992 (the last year of the rationing program), the rate structure shown in the table below applied to SFPUC customers.

Excess Use Charges

If Water Consumption Is (Over Allotment)	Excess Use Charge Will Be (Times Normal Rate)
Up to 10%	2
10.01 - 20%	8
20.01% or over	10

In the event that water was used in excess of the customer's specified allotment, the SFPUC could, after one written warning, install a flow restrictor on the customer's service line. The charge to install and remove the restricting device is shown in the table below. If a customer continued to consume water in excess of its allotment, the SFPUC had the authority to discontinue the customer's water service and require the customer to bear the cost for the re-connection of water service.

Fee For Installing Flow Restricting Devices	
Meter Size	Installation/Removal Cost
to 1”	$95
1” to 2”	$149
3” and larger	Actual cost

In addition to pricing disincentives for excess water use, numerous water use restrictions were adopted and enforced. San Francisco retail customers were required to comply with the following water use prohibitions and restrictions:

- Water waste, including but not limited to, any flooding or runoff into the street or gutters, was prohibited.
- Hoses could not be used to clean sidewalks, driveways, patios, plazas, homes, businesses, parking lots, roofs, awnings or other hard surfaces areas.
- Hoses used for any purpose had to have positive shutoff valves.
- Restaurants served water to customers only upon request.
- Potable water was not to be used to clean, fill or maintain levels in decorative fountains.
- Use of additional water was not allowed for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems were employed.
- Water service connections for new construction were granted only if water saving fixtures or devices were incorporated into the plumbing system.
- Use of potable water for consolidation of backfill, dust control or other non-essential construction purposes was prohibited.
- Irrigation of lawns, play fields, parks, golf courses, cemeteries, and landscaping of any type with potable water would be reduced by at least the amount specified for outside use in the adopted rationing plan.
- Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of service.
- Water used for all cooling purposes was to be recycled.
- The use of groundwater and/or reclaimed water for irrigation of golf courses, median strips, and similar turf areas was strongly encouraged.
- The use of groundwater and/or reclaimed water for street sweepers/washers was strongly encouraged.

In addition to water use prohibitions and directives specifically responsive to the drought, the SFPUC coincidentally was implementing long-term conservation programs, which also lowered water demands during the drought period (refer to the Demand Management discussion). Following the drought, several of the measures described above were adopted by San Francisco into permanent, on-going programs.

Water Management:

In addition to effecting reductions to water demands, the SFPUC also employed water management activities to control the severity of water shortages to its customers.

During the drought and for the first time in history, the SFPUC utilized a Delta supply within its system. The SFPUC imported water from the Delta through use of State Water Project South Bay Aqueduct facilities. The sources of water transferred included transfers via the California Emergency Water Bank, Placer County and the Modesto Irrigation District. The waters were diverted from the South Bay Aqueduct into the SFPUC's San Antonio Reservoir and then treated and integrated into SFPUC's water distribution system.

The amount of water actually delivered to the SFPUC was constrained due to numerous factors including the lack of willing sellers, allocation procedures, lack of priority in use of the State transmission facilities, storage constraints in San Antonio Reservoir, and water treatment constraints within the SFPUC's system. The total water that was imported into the SFPUC's system amounted to a maximum of approximately 31,000 acre-feet in one year, and in total for the drought period amounted to 59,000 acre-feet.

The importation of additional water into the SFPUC's system allowed the continuation of a 25 percent system-wide rationing program as compared to a potentially higher level of rationing had the transfers not occurred.

System Response and Effects:

The system-wide goal of reducing water use by 25 percent was achieved. However, the reduction was not accomplished without cost or hardship.

To achieve its annual 25 percent system-wide rationing goal, the SFPUC targeted a reduction of indoor consumption by 10 percent and outdoor consumption by 60 percent.

Due to the nature of the allocation formula for water allotments and the level of system-wide reduction goals, instances occurred where individual users or wholesale water customers were burdened with up to twice the system-wide average in delivery reductions.

Some of the costs incurred by individuals, property owners and renters include:

- The cost of installing low-flow toilets, retrofit kits for toilets and showerheads, and special low-water use landscaping and irrigation systems
- The financial losses resulting from loss of lawns, plants and trees due to the 60 percent reduction in water available for irrigation
- The cost of excess use charges ($12,300,000 in excess use charges was billed to retail accounts in fiscal year 1991-92 alone)

The ability of SFPUC's retail customers to achieve a 25 percent reduction in the future is highly unlikely due to the "hardening" of water demands that occurred during and subsequent to the drought. The rationing programs implemented by San Francisco during the 1987-92 drought were measured by comparison to calendar year 1987 water deliveries, i.e., pre-drought conditions.

During the 1987-92 drought San Francisco's retail and wholesale water customers implemented numerous conservation measures that have led to permanent per capita water usage savings. San Francisco's current water demand is likely hardened as compared to the 1987 level of water demand. This situation leads to a conclusion that comparable rationing goals (e.g., up to 25 percent reduction) would be more difficult to achieve since the drought, and would require measures in excess of those implemented during the 1987-92 drought to achieve a comparable percentage of delivery reduction.

As the level of rationing increases, the economic and societal impacts become more severe. The SFPUC has first hand experience in attempting to employ rationing to levels, which are intolerable to citizens and businesses.

In 1991, water storage had deteriorated and the SFPUC was forced to immediately adopt a 45 percent system-wide rationing plan. It was proposed the reduction would be achieved through a 33 percent reduction to inside water use and a 90 percent reduction to outside water use.

San Francisco's plan for meeting its rationing goal included the following minimum and maximum criteria:

- *Maximum Allocation for Single and Multi-family Residences.* No single-family residence shall receive an allocation of more than 300 gallons per day: no multi-family residence shall receive an allocation of more than 150 gallons per day times the number of living units in the building.

- *Minimum Allocation for All Residential Accounts.* A minimum of 50 gallons per day per documented resident will be allowed. However, a minimum allocation will not be approved to increase an allocation above current usage absent a documented change in circumstances.

- *Irrigation Services.* Accounts classified for irrigation only will be reduced by 90 percent.

- *Commercial/Industrial Allocations.* Commercial and industrial allocations will be reduced by 32 percent. Hospitals and other health care facilities may be subject to lesser restrictions subject to verification that all conservation measures are in place; such approval shall require an on-site conservation inspection.

- *Allocations for New Accounts.* Initial allocations will be established at 50 gallons per day. These allocations will be re-evaluated after customers have installed retrofit kits provided by the San Francisco Water Department. After verification of installation, allocations will be calculated on the basis of the number of documented residents within a household, or, in the case of commercial or industrial customers, on the basis of business data supplied to the Department.

Additional water use restrictions and prohibitions were enforced:

- The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains and airplanes was prohibited outside of a commercial washing facility.

- Exceptions to the above use restriction were windows on all vehicles and such commercial or safety vehicles requiring cleaning for health and safety reasons.

- Water used for all cooling purposes or for commercial car washes had to be recycled.

- The use of potable water on golf courses was limited to the irrigation of putting greens. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.

- The filling of new swimming pools, spas, hot tubs or the draining and refilling of existing pools, etc., was prohibited; topping off was allowed to the extent that the designated allocation was not exceeded.
- The irrigation of median strips with potable water was prohibited. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.
- The use of potable water for street sweepers/washers was prohibited. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.

Public and commercial response to 45 percent rationing was overwhelmingly negative. During the first weeks after notification of the program, SFPUC received over 2,000 appeal letters per day. In the month before rationing was returned to 25 percent, 19,000 appeals, 12,000 telephone calls, and 1,500 walk-in complaints occurred.

Both the allocation levels and new prohibitions required to meet this level of rationing would have had a devastating effect on commercial enterprises. Some water uses would have simply been prohibited. Simply put, rationing had been taken to a level that was considered intolerable to citizens and had become economically disastrous.

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 88-0155

WHEREAS, The San Francisco Water Department obtains water from the reservoirs operated by the Hetch Hetchy Water and Power and from local Bay Area reservoirs; and

WHEREAS, Due to critically low supplies of water within the reservoirs and anticipated low levels of inflow into the reservoirs, such that unless consumption is decreased there may be insufficient water supplies for human consumption, sanitation and fire protection; and

WHEREAS, Decreases in water consumption may be accomplished by reducing allocations to the Water Department's wholesale customers and by imposing water use restrictions on the Water Department's retail customers, as set forth in the Water Rationing Rules and Regulations, issued on April 21, 1988 and attached hereto as Water Rationing Rules and Regulations; and

WHEREAS, This Commission recognizes the need to declare a Water Shortage Emergency (Water Code Sec. 350, et. seq.) due to critically low water supplies now available, and the need for a reduction in water use by the San Francisco Water Department's Suburban Wholesale Customers; and

WHEREAS, This Commission recognizes the need to adopt a Water Conservation Program (Water Code Sec. 375, et. seq.) due to the critically low water supplies now available, and the need for a reduction in water use by the San Francisco Water Department's retail customers; and

WHEREAS, The City of San Jose is, by Resolution 85-0256, a temporary and interruptible wholesale customer of the Water Department, and the Settlement Agreement and Master Water Sales Contract between the City and County of San Francisco and certain Suburban Purchasers in San Mateo County, Santa Clara County and Alameda County (Settlement Agreement) requires action by the Commission to interrupt service to the City of San Jose (Section 8.17); and

WHEREAS, The City of Santa Clara is, by Resolution 85-0257, a temporary and interruptible wholesale customer of the Water Department, and the Settlement Agreement requires action by the Commission to interrupt service to the City of Santa Clara (Section 8.17); and

WHEREAS, Additional funding in the amount of $648,780 for FY 1988/89 has been identified by the Water Department for implementation of a mandatory water rationing program; and

WHEREAS, on April 21, 1988, the Water Department submitted to this Commission a Water Conservation Program; and

WHEREAS, The Conservation Program shall cease to exist in whole or in part at such time as the Commission finds that the supply of water available to the Water Department's service area has been replenished or augmented so that there are sufficient supplies to meet the needs of the Water Department's customers without the continued implementation of these measures; and

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I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of APRIL 22 1983

Romaine A. Boldridge
Secretary, Public Utilities Commission

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 88-0155

WHEREAS, The recommended Water Conservation Program has received wide-spread public distribution; and

WHEREAS, Members of the public have been given an opportunity to, and have expressed their views on the recommended Water Conservation Program in a public hearing; now, therefore be it

RESOLVED, That this Commission declares a Water Shortage Emergency; and

BE IT FURTHER RESOLVED, That this Commission adopts a Water Conservation Program; and

BE IT FURTHER RESOLVED, That this Commission approves the Water Conservation Program dated April 21, 1988 as amended April 28, 1988, and directs that it be placed in force on May 1, 1988; and

BE IT FURTHER RESOLVED, That it is not the Commission's intention to interrupt water service to the cities of San Jose and/or Santa Clara; however, pursuant to its obligation under the Settlement Agreement and Master Water Sales Contract this Commission authorizes the General Manager of the Water Department to interrupt water service to the cities of San Jose and/or Santa Clara if necessary to achieve the required water saving, however, prior to actual interruption of service to either the City of San Jose or Santa Clara, the General Manager of the Water Department shall report to the Commission the need for interruption and receive affirmation from the Commission prior to institution of the interruption; and the Commission further directs the General Manager of the Water Department to mitigate the effect of the interruptions to the extent possible and consistent with the needs of San Francisco's permanent customers; and

BE IT FURTHER RESOLVED, That this Commission hereby authorizes the additional budget needs to be added to the Water Department's Conservation Programmatic Budget, thus amending the Water Department's budget request for FY 1988/89; and

BE IT FURTHER RESOLVED, That this Commission hereby designates Tuesday, May 24, 1988 as the date for a public hearing by the Public Utilities Commission for considering proposals for rate increases and additional charges for water service and water supplied by the San Francisco Water Department to retail customers; and

BE IT FURTHER RESOLVED, That this Commission hereby designates Tuesday, May 24, 1988 as the date for a public hearing by the Public Utilities Commission for considering proposals for rate structure adjustments for water service and water supplied by the San Francisco Water Department to wholesale customers; and

BE IT FURTHER RESOLVED, That the revenue requirements and an analysis of the rate increases, rate structure adjustments and additional charges be made available for public inspection and review beginning Monday, May 16, 1988 in Room 287, City Hall, San Francisco.

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I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of APRIL 28 1988

Romaine A. Boldridge
Secretary, Public Utilities Commission

APPENDIX C

Summary of San Francisco's Response to 2012-2016 Drought Experience

APRIL 2021
WATER SHORTAGE CONTINGENCY PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

Summary of San Francisco's Response to 2012-2016 Drought Experience

Appendix to the 2020 Water Shortage Contingency Plan

Introduction

The purpose of this Drought Summary (Summary) is to provide an overview of the SFPUC's activities in response to the Statewide drought, beginning with State of Emergency declared by Governor Brown in January 2014. This drought is unprecedented, not only for being the driest period in California history, but also for the drastic measures taken by the State to mandate reductions in urban water use. This Summary primarily focuses on the SFPUC's retail service area (e.g., retail sales, excess use charges, customer outreach), but documentation related to the wholesale service area is included to a lesser extent.

This Summary is organized chronologically, with one section for each calendar year (CY): CY 2014, CY 2015, CY 2016, and CY 2017. The Summary covers activities through the end of Fiscal Year (FY) 2016-17 (i.e., through June 2017.

Each section provides an overview of the main drought-related activities that occurred during the year, and includes a timeline of regulatory actions made at the State and local levels and a summary of retail water use by sector compared to the CY 2013 baseline.

Summary of Activities in Calendar Year 2014

The three-year period from October 2011 to September 2014 was the driest in California's hydrologic record and, as a result, reservoir storage, snowpack, and reservoir inflows were significantly lower than normal throughout the State. The unprecedented dry weather conditions prompted Governor Jerry Brown to declare a drought emergency for the State of California in January 2014 (Proclamation 1-17-2014). This action spurred the SFPUC to request that all customers of the Regional Water System (RWS) voluntarily reduce water use by at least 10% (Press Release 3-14), corresponding to Stage 1 of the Retail Water Shortage Allocation Plan.

Soon after, the San Francisco Mayor's Office issued a formal executive directive requiring that all City departments develop individual water conservation plans and take immediate steps to achieve a mandatory 10% reduction in their water consumption (Executive Directive 14-01). Moreover, in July 2014, new emergency regulations issued by the SWRCB (Resolution 2014-0038) prompted the SFPUC to implement outdoor water waste restrictions and require a mandatory 10% reduction in outdoor water use (Resolutions 14-0121 and 14-0140).

At this time, starting in October 2014, mandatory reductions in water use and corresponding excess use charges applied only to dedicated irrigation customers for a few reasons. First, requiring reductions only in irrigation was in line with the State's regulations targeting outdoor water use. The call for a voluntary reduction of 10% still applied to all customers system-wide. Second, the outdoor sector had the most potential for water savings. Third, the SFPUC's Customer Care and Billing System (CC&B) was undergoing an upgrade in summer 2014, so it was not possible to implement any new rationing programs in CC&B until fall 2014. To implement the Mandatory Irrigation Allocation Program, and workaround system was created outside of CC&B. Because the pool of dedicated irrigation customers was relatively small (approximately 1,600 accounts), it was manageable with the workaround system. It would not have been feasible or cost-effective to create a workaround system for any large sectors (e.g., residential).

Per the SFPUC's existing Interruptible Water Service rate (Rate Schedules W-3B and W-34), a subset of dedicated irrigation customers, known as interruptible customers, pay reduced rates, but are subject more stringent reductions during water shortages. Since 2007, this rate was made available only to irrigation customers for public uses within the City and County of San Francisco (i.e., municipal City departments). However, on May 13, 2014, the SFPUC adopted Resolution 14-0070, which expanded Interruptible Water Service to all retail irrigation uses inside and outside the City and County of San Francisco. Coupled with the water use restrictions due to the drought, this resolution prompted SFPUC staff to make changes to and clarify the implementation of the Interruptible Water Service rate effective July 1, 2014. In June 2014, all eligible irrigation account holders, including both municipal and private customers, were notified of the opportunity to opt-in to the Interruptible Water Service program. Most City departments opted to remain in the program, and several private customers also opted to participate in the program. Implementation of the Interruptible Water Service rate was revised again in February 2015 with the adoption of formal rules and regulations for administering Interruptible Water Service; this is described in the chapter for CY 2015.

In June 2014, the SFPUC launched a multilingual “Water Conservation is Smart and Sexy” Citywide public education campaign. The advertisements were designed to capture public attention and present everyday water conservation tips and information about the drought. A combination of television, newspaper, billboard, bus, commuter transit station, and social media advertisements encouraged individuals to adjust their water use practices and pursue water-efficient plumbing fixture upgrades. The campaign also advised individuals to visit SFPUC water conservation web content and learn about the suite of services that are offered. As a result of the campaign, SFPUC water conservation web traffic increased by more than fourfold when comparing June-October of 2013 to June-October of 2014.

The SFPUC also implemented an education and notification program about wasteful outdoor water use activities, such as spraying or washing down outdoor hardscapes unless required for health and safety purposes; watering landscape in a manner that causes runoff to the sidewalk; and operating a hose without the use of an automatic shut-off spray nozzle. One of the key actions included targeted messaging to top water-using residential accounts, individuals demonstrating outdoor water waste, and commercial properties performing maintenance of outdoor hardscapes. The SFPUC also established a public water waste reporting and tracking system through the City of San Francisco’s centralized 3-1-1 online and telephone response center.

Retail customers collectively saved 3.3 MGD, or 4.8%, in CY 2014 compared to CY 2013. Wholesale customers collectively saved 13.4 MGD, or 8.9%, of RWS supplies compared to CY 2013. Both sets of customers fell short of the voluntary system-wide goal of 10% that was declared in January 2014. Taking both the retail and wholesale service areas into account, system-wide savings in CY 2014 was 16.7 MGD, or 7.7%, compared to CY 2013 and did not meet the voluntary 10% goal.

Summary of Activities in Calendar Year 2015

In 2015, California was experiencing its fourth year of a severe drought and entering into a fifth year. The drought State of Emergency issued by Governor Brown in January 2014 remained in effect, and the SWRCB enacted additional emergency conservation regulations to promote even more conservation throughout the State (Resolution 2014-0013). These included mandatory restrictions on outdoor water use, as well as prohibitions on water use by businesses, which the SFPUC then adopted locally (Resolution 15-0102). Shortly thereafter, under an Executive Order (EO) issued by the Governor in April 2015 (EO B-29-15), a mandatory Statewide water use reduction of 25%, compared to a 2013 baseline, took effect starting June 2015 (Resolution 2015-0032). When the regulations were initially adopted by the SWRCB, this mandatory reduction was intended to remain in place until February 2016 unless extended or modified if the drought continued.

To help achieve the Statewide conservation goal of 25%, the SWRCB assigned the SFPUC a conservation standard of 8% in recognition of its low residential per capita water use. The 8% standard represents the lowest tier in the SWRCB emergency regulations. In response to the mandatory reduction issued by the State, the SFPUC adopted the 2015-2016 Drought Program (Resolution 15-0119 and 15-0149), which:

- Continued the call for a 10% reduction in water use by all customers system-wide;
- Increased the mandatory reduction in water use by dedicated irrigation customers from 10% to 25%, subject to excess use charges of 100% ("1x");
- Established a mandatory reduction in water use by Interruptible Water Service accounts at 30%, subject to excess use charges of 300% ("3x");
- Adjusted existing reduced wastewater flow factors to reflect a 25% reduction in irrigation usage

The SFPUC decided to maintain its call for a voluntary 10% reduction system-wide for continuity in messaging because (1) retail customers had already achieved about 9% through the first restriction period (i.e., 10% Mandatory Irrigation Allocation Program starting in October 2014), and (2) supply was being successfully managed such that further reductions were not needed. However, a further reduction on irrigation use was imposed in order to provide additional assurance that the 8% reduction mandated by the SWRCB could be met. The SFPUC continued to target dedicated irrigation customers because, similar as for initiation of the 10% Mandatory Irrigation Allocation Program in October 2014, this sector was considered to have the highest potential for savings and could be most feasibility managed through CC&B. Mandatory rationing for other sectors was discussed, but it would have been difficult to set targets equitably and to determine a sensible way to track water use (i.e., volume normalized per dwelling unit, square foot, or occupant). Any additional savings that could have been achieved through rationing would not have been worth the effort to implement rationing given the significant savings already achieved. Ultimately, SFPUC management desired a program that would avoid mandatory rationing while achieving the targeted level of savings.

It should be noted that in February 2015, prior to development of the 2015-2016 Drought Program and unrelated to the drought, the SFPUC adopted rules and regulations for administering Interruptible Water Service (Resolution 15-0040). The rules and regulations allow eligible irrigation customers to opt into the Interruptible Water Service program and receive water service at a reduced rate (about 9% lower than regular commercial water rates). By opting in, these customers would be subject to service interruption and/or greater mandatory water use reductions, along with greater excess use charges, during water shortages and other emergencies at the discretion of the SFPUC Water Enterprise. The Interruptible Water Service rules had to be amended as part of the 2015-2016 Drought Program because the existing rules did not include a water shortage scenario (or stage) that was set forth by the Drought Program. Specifically, reductions and excess use charges were not defined for interruptible customers during a stage corresponding to a 10% system-wide water reduction with a mandatory reduction on dedicated irrigation. SFPUC staff initially proposed that interruptible customers should be subject to a 25% reduction and excess use charge of 200% ("2x") (Resolution 15-0119). However, the Commission requested that staff evaluate the feasibility and potential impacts of imposing more stringent reductions and excess use charges on interruptible customers. Based on an analysis of hypothetical financial impacts to existing interruptible customers assuming historical water use, with a focus on the largest interruptible customer (the San Francisco Recreation and Parks Department), staff recommended that interruptible customers be subject to a 30% reduction and excess use charge of 300% ("3x"). This proposal was adopted by the Commission and the 2015-2016 Drought Program was amended accordingly (Resolution 15-0149).

With the launch of the 2015-2016 Drought Program in July 2015, the workaround system that was created for the initial 10% Mandatory Irrigation Allocation Program was replaced with full integration of the 25% Mandatory Irrigation Allocation Program in CC&B. However, there was a delay in implementing the rationing program specific to Interruptible Water Service accounts until November 2015 because it took more time than expected to aggregate allocations and usage at the department level.

Although mandatory reductions were not imposed on residential and commercial customers, the SFPUC provided guidance and outreach to those customers on how to track and achieve water savings. In the SFPUC's on-line bill management system My Account, a Drought Water Use Target line was added to daily use charts for each single-family residential, multi-family residential, and non-residential account. The target reflected a 10% reduction from the account's historic 2013 water use. To aid customers in tracking their conservation in the future, the SFPUC started investigating the feasibility of fractional billing which was eventually implemented and launched in January 2017.

In addition to imposing conservation standards on individual urban water suppliers, the emergency regulations adopted by the SWRCB in May 2015 included additional water use prohibitions (Resolution 2015-0032). The SFPUC adopted additional mandatory restrictions to impose the State's prohibitions in the SFPUC retail service area if they had not already been addressed by existing SFPUC water use restrictions. The restrictions adopted by the SFPUC in CY 2015 are listed below:

- Watering outdoor landscapes with potable water during and within forty-eight (48) hours after a rain event (Resolution 15-0102)
- Not providing guests the option to refuse daily laundering of towels and linens at hotels and motels, and not prominently displaying notice of this option in each guestroom (Resolution 15-0102)

- Irrigation with potable water of ornamental turf on public street medians (Resolution 15-0119)

The SFPUC expanded its efforts to educate the public about wasteful water use activities restricted by the State, including runoff from irrigation and hardscape washing. SFPUC field inspectors continued to keep an eye out for water waste during daily rounds, and conservation staff responded to an increasing number of water waste reports submitted through San Francisco's 3-1-1 online and telephone response center.

The SFPUC continued to inform customers on the drought, water efficient practices, and new regulations through a variety of means in addition to those described above. The drought outreach campaign from the previous summer was updated and re-launched. In June 2015, irrigation customers were sent letters describing the Mandatory Irrigation Allocation Program and providing monthly account allocations through February 2016. The letters also provided an opportunity for the account holder to participate in or opt out of the Interruptible Service Program. The SFPUC also sent letters to account holders with reduced flow factors to notify them of adjustments to their reduced flow factor, or lack thereof in the case of adjustments that were too small to implement.

As the 2015-2016 Drought Program was being developed, SFPUC management and staff contemplated temporarily suspending high bill appeals, flow factor appeals, and interruptible rates during the drought as these processes could be considered counterproductive to conservation. However, the City Attorney's Office advised against suspending these processes, and instead, the SFPUC proceeded with the adjustment to reduced flow factors.

In December 2015, SFPUC management and staff met to discuss the effectiveness of the 2015-2016 Drought Program to date in anticipation of an extension to the State mandates in the beginning of 2016 as directed by the Governor (EO B-36-15). In brief, the Drought Program was effective at reducing water use across all customer sectors (except industrial, which is a small sector), and was on track to meet its objectives. Challenges in implementing program criteria and modifications to the billing system (CC&B) were also discussed at this meeting as well as at a follow-up meeting specifically regarding CC&B held in May 2016.

The April 2015 EO B-29-15 directed the California Department of Water Resources (DWR) to update the State's Model Water Efficient Landscape Ordinance (MWELO) to increase water efficiency standards for new and existing landscapes. In July 2015, the California Water Commission approved a revised MWELO. Accordingly, the SFPUC adopted amendments to San Francisco's Water Efficient Irrigation Ordinances and the related SFPUC rules (Section F of the Rules and Regulations Governing Water Service to Customers) to comply with the State's revisions (Resolution 15-0221).

The next few pages provide a timeline of the State and local regulatory actions described above, retail water use by sector compared to the CY 2013 baseline, and monthly production data submitted to the SWRCB per the emergency regulations adopted in July 2014. The monthly reports to the SWRCB include residential per capita estimates as well as implementation and enforcement metrics. For metrics related to excess use charges, see the summary provided in the introduction of this report.

Summary of San Francisco's Response to 2012-2016 Drought Experience

Retail customers collectively saved 7.9 MGD, or 11.7%, in CY 2015 compared to CY 2013, thus exceeding the voluntary system-wide goal of 10%. Looking specifically at retail irrigation use, dedicated irrigation customers collectively saved 0.7 MGD, or 27.9%, over the course of the 10% Mandatory Irrigation Allocation Program (October 2014 through June 2015), far exceeding program's goal. Wholesale customers also exceeded the voluntary system-wide goal of 10% by collectively saving 33.7 MGD, or 22.4%, of RWS supplies compared to CY 2013. Taking both the retail and wholesale service areas into account, system-wide savings in CY 2015 was 41.6 MGD, or 19.1%, compared to CY 2013 and exceeded the voluntary 10% goal.

Summary of Activities in Calendar Year 2016

Although hydrologic conditions improved during the winter of 2015/2016, the Statewide drought continued into its fifth consecutive year. In anticipation of a dry winter, the Governor issued EO B-36-15 in November 2015 directing the SWRCB to extend the emergency regulations adopted in May 2015 beyond their initial expiration date in February 2016. In response, the SWRCB updated and extended the emergency regulations through October 2016 (Resolution 2016-0007). The most significant update to the emergency regulations was the addition of credits and adjustments to urban water suppliers' conservation standards that consider the differences in climate, growth, and investments in creating new, local, drought-resilient sources of potable water supply.

To comply with the SWRCB's extended emergency regulations, the SFPUC maintained its 2015-2016 Drought Program. The SFPUC did not apply for an adjustment to its existing 8% conservation standard because its customers were doing well to conserve well beyond that system-wide. Letters were sent to irrigation customers notifying them of the extension of the 25% Mandatory Irrigation Allocation Program, and included a new batch of monthly allocations from March through October 2016.

Despite improved conditions during the past winter, Governor Brown issued EO B-37-16 in May 2016 aiming to make water conservation a California way of life. Among other directives, the EO directed the SWRCB to extend its emergency regulations, which had previously been extended through October 2016, through January 2017[1]. Additionally, the EO called for the emergency regulations to be adjusted in recognition of differing water supply conditions throughout the State. In response, the SWRCB required that all urban water suppliers self-certify their water supply reliability and corresponding conservation standard by June 2016 (Resolution 2016-0029). The self-certification process, also referred to as a "stress test," assumed three additional dry years. The self-certified conservation standard replaces the existing State-developed conservation standard (i.e., 8% for SFPUC), and will remain in effect through January 2017[2]. SFPUC staff analyzed the regulations and described proposed actions for its Commissioners in a memo dated May 18, 2016.

To comply with the revised emergency regulations, the SFPUC conducted the self-certification procedures and determined that potable water supplies would be sufficient to meet both retail and wholesale demands over the next three years. Thus, the revised conservation standard for the SFPUC retail system was established to be 0%, rather than the existing 8% conservation standard. Despite its self-certified conservation standard of 0%, the SFPUC continued to promote and encourage conservation in line with the State mandates. Specifically, the SFPUC maintained its call for a voluntary 10% system-wide reduction in water use over the 2013 baseline in light of the proposed SWRCB emergency regulations and the fact that the Hetch Hetchy Regional Water System was still recovering from the drought. System storage was not anticipated to fill in 2016, and the next year's hydrology remained uncertain.

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[1] The regulation was set to expire in February 28, 2017 per the Office of Administrative Law.

[2] Same as previous footnote.

However, in recognition of improved hydrologic conditions and the reduced conservation standard, the SFPUC adopted changes to the 2015-2016 Drought Program in June 2016 to ease mandatory reductions on outdoor irrigation with potable water (Resolution 16-0130). These changes included:

- Ceasing the 25% mandatory reduction in water use by dedicated irrigation customers and corresponding excess use charges;
- Reducing the mandatory reduction in water use by interruptible customers from 30% to 10%, subject to excess use charges; and
- Reverting reduced wastewater flow factors that had been adjusted to reflect a 25% reduction in irrigation usage back to their pre-adjusted reduced values.

In July 2016, the SFPUC sent letters to irrigation customers and customers with adjusted flow factors regarding the lifted restrictions. The letters to irrigation customers offered account holders the opportunity to participate in the Interruptible Water Service program for FY 2016-17 effective August 2016.

EO B-37-16 also directed the SWRCB to permanently prohibit practices that waste potable water. While the SWRCB has yet to take action to make the prohibitions permanent, the SFPUC updated its water waste restrictions and made temporary restrictions permanent in line with the Executive Order (Resolution 16-0127).

In June 2016, the SFPUC surveyed San Francisco residents to learn what they did at home to achieve water savings during the drought, how long water-savings from these actions might last, and how people got information about the drought and ways to conserve. Overall, the poll showed that most respondents are informed about the drought, cut back their water use, feel they and others could conserve even more but need direction on what more they should do. The SFPUC will use the results to help shape continued outreach about all the ways people can save water whether they own or rent, and live in an apartment or single family home.

In addition to addressing the current drought through temporary regulations, EO B-37-16 also builds on the conservation accomplished during the current drought and seeks to establish longer-term water conservation and efficiency measures through the following directives:

- Use Water More Wisely – Develop new urban water use targets that generate more water conservation than existing SBX7-7 requirements.
- Eliminate Water Waste – Reduce water loss.
- Strengthen Local Drought Resilience – Improve urban Water Shortage Contingency Plans and reporting requirements.

The EO calls for DWR, SWRCB, and the California Department of Food and Agricultural (CDFA), in coordination with the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) (collectively referred to as the "EO State Agencies") to seek input from stakeholders on implementation of EO B-37-16. The Urban Advisory Group (UAG) was formed by the EO State Agencies to provide input and advice on recommendations and approaches regarding EO directives applicable to urban water use.

Although the SFPUC is not a member of the UAG, SFPUC staff closely monitored the development of the recommendations and framework report that was finalized by the EO Agencies in April 2017. SFPUC staff continue to track the development of the resulting legislation. Because this long-term water use efficiency framework was not intended to influence the current drought, ***this Drought Summary does not cover activities related to the long-term directives of EO B-37-16***.

Separate from SWRCB emergency regulations and Governor EOs, State legislation was signed by the Governor on August 29, 2016 requiring urban retail water suppliers to set rules for identifying and discouraging excessive residential water consumption during a prescribed statewide or local drought. The provisions of this legislation, known as Senate Bill (SB) 814, took effect January 1, 2017 and are described further in the next chapter as the SFPUC took action in January 2017 to implement the provisions.

Retail customers collectively saved 8.8 MGD, or 13.0%, in CY 2016 compared to CY 2013, thus exceeding the voluntary system-wide goal of 10%. Looking specifically at retail irrigation use, dedicated irrigation customers collectively saved 1.2 MGD, or 38.5%, over the course of the 25% Mandatory Irrigation Allocation Program (July 2015 through June 2016), far exceeding program's goal. Wholesale customers also exceeded the voluntary system-wide goal of 10% by collectively saving 31.7 MGD, or 21.1%, of RWS supplies compared to CY 2013. Taking both the retail and wholesale service areas into account, system-wide savings in CY 2016 was 40.5 MGD, or 18.6%, compared to CY 2013 and exceeded the voluntary 10% goal.

Summary of Activities in Calendar Year 2017 (through June 2017)

The winter of 2016/2017 was one of California's wettest winters on record and marked the end of the five-year drought in most of the State. Despite much improved hydrologic conditions, portions of state remained dry and groundwater basins remained depleted. Thus, in February 2017, the SWRCB readopted its emergency regulations (i.e., the stress test approach) and extended them through October 2017 with the intent to reconsider repealing the regulations in May should Statewide water supply conditions improve (Resolution 2017-0004). However, on April 7, 2017, Governor Brown issued EO B-40-17 to lift the drought emergency throughout the State except for four counties that continue to suffer from water supply shortages (Fresno, Kings, Tulare, and Tuolumne). In response to this EO, on April 26, 2017, the SWRCB rescinded the stress test and conservation standard portions of its emergency regulations for all of California except for the four counties identified in the EO (Resolution 2017-0024). Monthly water use reporting and water waste prohibitions remain in place until the emergency regulations expire in November 2017, though the SWRCB is working to make these requirements permanent as directed by EO B-37-16.

While EO B-40-17 ended the Statewide emergency drought proclamation put in place by the Governor in January 2014 (Proclamation 1-17-2014), it also marks a transition to the long-term water use efficiency framework to make water conservation a California way of life under EO B-37-16.

Prior to the Governor issuing EO B-40-17, SFPUC staff reviewed RWS conditions and determined that precipitation and snowpack were well above normal. It was anticipated that the system would fill over the course of the year. Because of these favorable supply conditions and because the SFPUC was subject to a 0% self-certified conservation standard per the SWRCB emergency regulations at the time, the SFPUC lifted its call for a voluntary 10% reduction in water use system-wide on April 11, 2017 (Resolution 17-0075). The SFPUC also notified its wholesale customers that it would no longer be requesting voluntary reductions.

As noted in the chapter for CY 2016, the Governor signed into law SB 814, which required urban retail water suppliers to set rules for identifying and discouraging excessive residential water consumption during a prescribed statewide or local drought. To implement this legislation locally, in January 2017, the SFPUC adopted rules and regulations to establish a 500-gallon-per-day threshold for single-family households and individually-metered multi-family units (Resolution 17-0010). The threshold would be effective during designated drought periods in which mandatory reduction on residential customers are imposed, and result in a $150 excess use fine for each 30-day period a customer's average daily water use exceeds the threshold.

During the 12-month period of July 2016 to June 2017, retail customers collectively saved slightly less water in FY 2016-17 (with only the voluntary 10% system-wide reduction in place) compared to FY 2015-16 (when 25% Mandatory Irrigation Allocation Program was in place): 8.6 MGD (12.7%) compared to 9.1 MGD (13.4%) savings. For the same periods of time, dedicated irrigation customers also saved slightly less water: 1.1 MGD (35.2%) compared to 1.2 MGD (38.5%) savings. However, both retail and wholesale customers still exceeded the voluntary 10% goal.

APPENDIX D

San Francisco Public Utilities Commission Resolution Adopting 2020 Water Shortage Contingency Plan

APRIL 2021
WATER SHORTAGE CONTINGENCY PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

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2020
WATER SHORTAGE CONTINGENCY PLAN
for the City and County of San Francisco

PUBLIC REVIEW DRAFT

April 2021

Prepared by: The San Francisco Public Utilities Commission

San Francisco
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Services of the San Francisco Public Utilities Commission

APPENDIX L

Resolution to Adopt the 2020 Urban Water Management Plan

PUBLIC REVIEW DRAFT, APRIL 2021
2020 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

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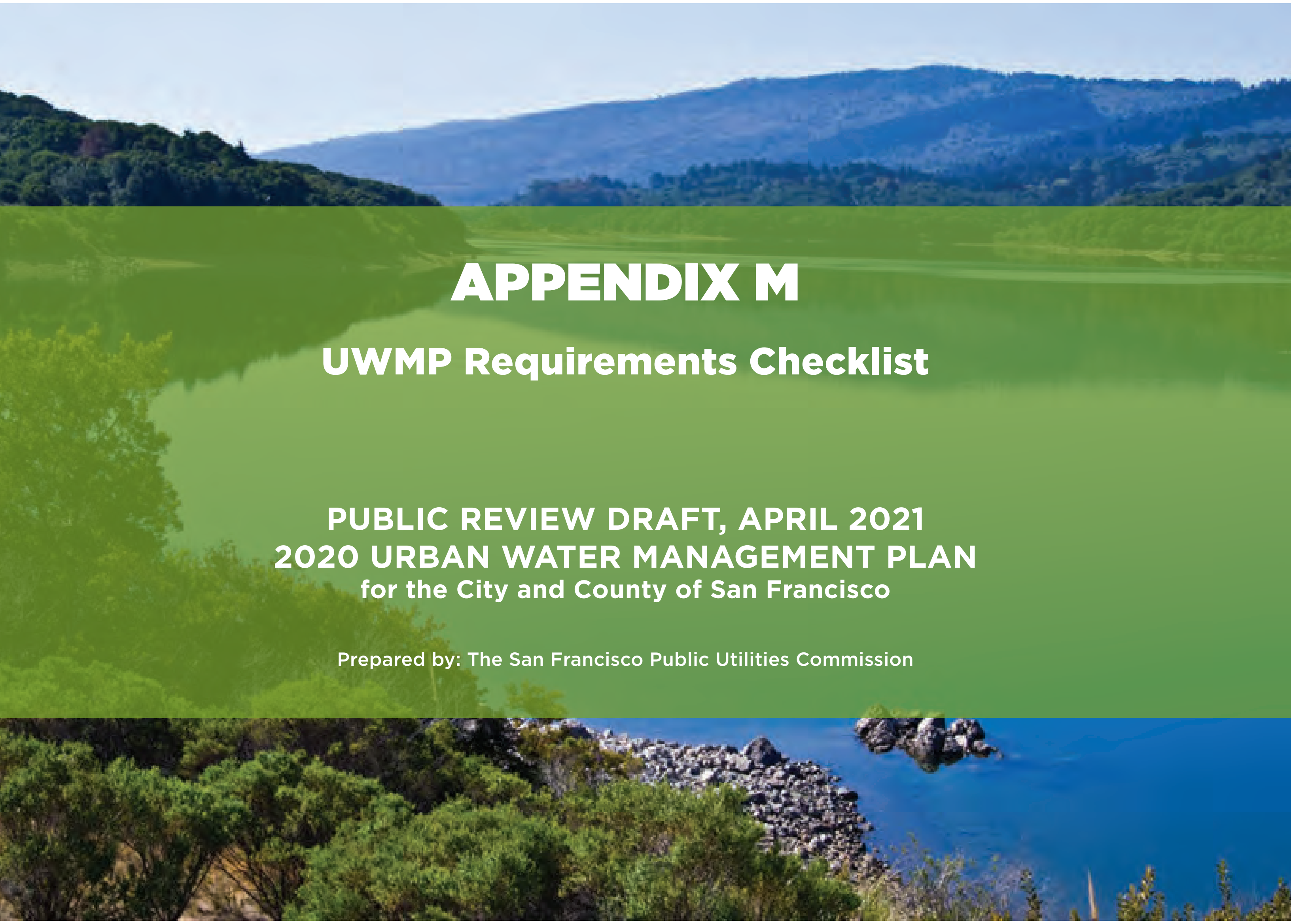
Appendix L - Resolution to Adopt the 2020 Urban Water Management Plan

To be included in the final version of UWMP



APPENDIX M

UWMP Requirements Checklist

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Water Code Section	Summary as Applies to UWMP	2020 UWMP Location	
		Retail	Wholesale
Summary			
10630.5	Each plan shall include a simple description of the supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information.	Section 1	Section 1
Plan Preparation			
10620(b)	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Section 10.1	Section 10.1
10620(d)(2)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Section 2.3.1 and Appendix C	Section 2.3.1 and Appendix C
10642	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Appendix C	Appendix C
System Description			
10631(a)	Describe the water supplier service area.	Section 3.2	Section 3.3
10631(a)	Describe the climate of the service area of the supplier.	Section 3.2.1	section 3.3.1
10631(a)	Indicate the current population of the service area.	Table 3-3 & Table 5-1	Table 3-4
10631(a)	Provide population projections for 2025, 2030, 2035, 2040 and optionally 2045.	Table 3-3	Table 3-4
10631(a)	Describe other social, economic, and demographic factors affecting the supplier's water management planning.	Section 3.2.2	Section 3.3.2
10631(a)	Describe the land uses within the service area.	Section 3.2.2	Section 3.3.2
System Water Use			
10631(d)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	Section 4.1	Section 4.2
10631(d)(3)(A)	Report the distribution system water loss for each of the 5 years preceding the plan update.	Section 4.1.3	N.A.
10631(d)(3)(C)	Retail suppliers shall provide data to show the distribution loss standards were met.	Section 4.1.3	N.A.
10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	Section 4.1.5	N.A.

System Description and Baselines and Targets			
10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	Section 5.1 & Appendix D	N.A.
10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use of the 5 year baseline. This does not apply if the suppliers base GPCD is at or below 100.	Section 5.2	N.A.
10608.24(a)	Retail suppliers shall meet their water use target by December 31, 2020.	Section 5.3	N.A.
10608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	N.A.	N.A.
10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	N.A	Section 5.4 & Section 10.3
10608.4	Retail suppliers shall report on their progress in meeting their water use targets. The data shall be reported using a standardized form.	Appendix D	N.A.
10631(a)	Indicate the current population of the service area.	Table 3-3 & Table 5-1	N.A.
System Supplies			
10631(b)	Identify and quantify the existing and planned sources of water available for 2020, 2025, 2030, 2035, 2040 and optionally 2045.	Table 6-3 & Table 6-5	Table 6-3
10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	Section 6.2.1.1	N.A
10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought.	Section 8.2	Section 8.2
10631(b)(2)	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	Section 6.2.5	N.A
10631(b)(3)	Describe measures taken to acquire and develop planned sources of water.	Section 6.2.2 & Section 7.4	N.A

10631(b)(4)(A)	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	Section 6.2.1.1	N.A
10631(b)(4)(B)	Describe the groundwater basin.	Section 6.2.1.1	N.A
10631(b)(4)(B)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	Section 6.2.1.1	N.A
10631(b)(4)(B)	For unadjudicated basins, indicate whether or not the department has identified the basin as a high or medium priority. Describe efforts by the supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	Section 6.2.1.1	N.A
10631(b)(4)(C)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	Section 6.2.1.1 & Table 6-2	N.A
10631(b)(4)(D)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	Section 6.2.1.1 & Table 6-5	N.A
10631(c)	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	Section 7.4.2 & Section 7.5	Section 7.4.2 & Section 7.5
10631(f)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and for a period of drought lasting 5 consecutive water years.	Section 7.4	Section 7.4
10631(g)	Describe desalinated water project opportunities for long-term supply.	Section 7.4.2	Section 7.4.2
10631(h)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) - if any - with water use projections from that source.	N.A	N.A
10631(h)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	N.A	Appendix C

System Supplies (Recycled Water)			
10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	Table 6-4	N.A
10633(c)	Describe the recycled water currently being used in the supplier's service area.	Section 6.2.1.3	N.A
10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	Section 6.2.2 & Table 6-5	N.A
10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	Table 6-5 & Table 6-3	N.A
10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	Section 6.2.2.3	N.A
10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	Section 6.2.2.3	N.A
Water Supply Reliability Assessment			
10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Section 6.2.2, Section 7.4	Section 7.2, Section 7.4 & Section 7.5
10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Section 6.1.2 & Section 6.2.3	Section 6.1.2
10635(a)	Assess the water supply reliability during normal, dry, and multiple dry water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Section 8.3 & Section 8.4	Section 8.3 & Section 8.4
10635(b)	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Section 8.5	N.A
10635(b)(1)	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts 5 consecutive years.	Section 8.5.1, Section 8.5.2, Section 8.2	N.A
10635(b)(2)	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Section 8.5.2, Section 8.5.3	N.A

10635(b)(3)	Include a comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.	Section 8.5.4	N.A
10635(b)(4)	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change condition, anticipated regulatory changes, and other locally applicable criteria.	Section 8.2.2 & Section 8.5.4	N.A
Water Shortage Contingency Planning			
10632(a)	Provide a water shortage contingency plan (WSCP) with specified elements below.	Appendix K	Appendix K
10632(a)(2)(A)	Provide the written decision-making process and other methods that the supplier will use each year to determine its water reliability.	Appendix K Section 2.5 & Figure 2-1	Appendix K Section 2.5 & Figure 2-1
10632(a)(2)(B)	Provide data and methodology to evaluate the supplier's water reliability for the current year and one dry year pursuant to factors in the code.	Appendix K Section 2	Appendix K Section 2
10632(a)(3)(A)	Define six standard water shortage levels of 10, 20, 30, 40, 50 percent shortage and greater than 50 percent shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Appendix K, Section 3, Table 3-1, Table 3-2	Appendix K, Section 3.1, Table 3-1
10632(a)(3)(B)	Suppliers with an existing water shortage contingency plan that uses different water shortage levels must cross reference their categories with the six standard categories.	Not Applicable; supplier uses 6 standard categories	Not Applicable; supplier uses 6 standard categories
10632(a)(4)(A)	Suppliers with water shortage contingency plans that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Not Applicable; supplier will meet shortage with demand reduction actions as described in Appendix K, Section 4	Not Applicable; supplier will meet shortage with Water Shortage Allocation Plan as described in Appendix K, Section 3
10632(a)(4)(B)	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Appendix K Section 4, Table 4-2	Not Applicable; supplier will meet shortage with Water Shortage Allocation Plan as described in Appendix K, Section 3

10632(a)(4)(C)	Specify locally appropriate operational changes.	Appendix K Section 4.4	Not Applicable; supplier will meet shortage with Water Shortage Allocation Plan as described in Appendix K, Section 3
10632(a)(4)(D)	Specify additional mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions are appropriate to local conditions.	Appendix K Section 4.2, Table 4-1, Table 4-2	Not Applicable; supplier will meet shortage with Water Shortage Allocation Plan as described in Appendix K, Section 3
10632(a)(4)(E)	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Appendix K Table 4-2	Not Applicable; supplier will meet shortage with Water Shortage Allocation Plan as described in Appendix K, Section 3
10632(a)(5)(A)	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Appendix K Section 2.5, Figure 2-1, Section 5	Appendix K Section 2.5, Figure 2-1, Section 5
10632(a)(5)(B) 10632(a)(5)(C)	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Appendix K Section 2.5, Figure 2-1, Section 5	Appendix K Section 2.5, Figure 2-1, Section 5
10632(a)(7)(A)	Describe the legal authority that empowers the supplier to enforce shortage response actions.	Appendix K Section 7	Appendix K Section 7
10632(a)(7)(B)	Provide a statement that the supplier will declare a water shortage emergency Water Code Chapter 3.	Appendix K Section 7	Appendix K Section 7
10632(a)(7)(C)	Provide a statement that the supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Appendix K Section 7	Appendix K Section 7
10632(a)(8)(A)	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Appendix K Section 8	Appendix K Section 8
10632(a)(8)(B)	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Appendix K Section 8	Appendix K Section 8
10632(a)(8)(C)	Describe the cost of compliance with Water Code Chapter 3.3: Excessive Residential Water Use During Drought.	Appendix K Section 8	Appendix K Section 8

10632(a)(9)	Retail suppliers must describe the monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance.	Appendix K Section 9	N.A
10632(a)(10)	Describe reevaluation and improvement procedures for monitoring and evaluation the water shortage contingency plan to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Appendix K Section 11	Appendix K Section 11
10632(b)	Analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	Appendix K Section 4	N.A
Demand Management Measures			
10631(e)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years.	Section 10.1	N.A
10631(e)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	N.A	Section 10.2
Plan Adoption, Submittal and Implementation			
10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets.	Section 11.1 and Appendix L	N.A
10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10621(f)	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10635(c)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 60 days after the submission of the plan to DWR.	Section 11.1, Appendix C, Appendix M Section 12	Section 11.1 and Appendix C, Appendix M Section 12
10642	Provide supporting documentation that the urban water supplier made the plan and contingency plan available for public inspection, published notice of the public hearing, and held a public hearing.	Section 11.1 and Appendix C	Section 11.1 and Appendix C

10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10642	Provide supporting documentation that the plan and contingency plan has been adopted as prepared or modified.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10645(a)	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
10645(b)	Provide supporting documentation that, not later than 30 days after filing a copy of its water shortage contingency plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Section 11.1 and Appendix C	Section 11.1 and Appendix C
Energy Intensity			
10631.2(a)	The UWMP must include energy intensity information as stated in the code.	Appendix I	Appendix I

2020
URBAN WATER MANAGEMENT PLAN

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