State of the Regional Water System

Hetch Hetchy Regional Water System

Services of the San Francisco Public Utilities Commission

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Table of Contents

Tables

Figures

List of Abbreviations

AACEI	Association for the Advancement of Cost Engineering International
AAR	Alternatives Analysis Report
AC	alternating current
ACDD	Alameda Creek Diversion Dam
ADAS	automatic data acquisition system
AEP	Alameda East Portal
AF	acre-feet
AMI	advanced meter infrastructure
AMMP	Algae Monitoring and Mitigation Plan
AMP	Asset Management Plan
AMSC	Asset Management Steering Committee
ARV	air release valve
AS	Alameda Siphon
AVV	air vacuum valve
AWIA	America's Water Infrastructure Act of 2018
AWP	Alameda West Portal
AWWA	American Water Works Association
BDPL	Bay Division Pipeline
BFV	butterfly valve
BHR	bioregional habitat restoration
BMP	best management practice
BO	blowoff valve
B&V	Black & Veatch
CalEPA	California Environmental Protection Agency
CALPL	Calaveras Pipeline
Cal OES	California Governor's Office of Emergency Services
Cal Water	California Water Service Company
CatEx	categorical exclusion
CCR	California Code of Regulations
CSSAPL	Crystal Springs-San Andreas Pipeline
CCSF	City and County of San Francisco
CDD	City Distribution Division
CDRP	Calaveras Dam Replacement Project

CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIP	Capital Improvement Program
CML	cement -mortar lining
CMMS	computerized maintenance management system
COF	consequence of failure
CP	cathodic protection
CRT	Coast Range Tunnel
CSBT	Crystal Springs Bypass Tunnel
CSOS	Crystal Springs Outlet Structure
CSPL	Crystal Springs Pipeline
CSPS	Crystal Springs Pump Station
DBP	disinfection byproduct
DC	direct current
DDW	Division of Drinking Water
DEOP	Division Emergency Operations Plan
DLR	detection limit for purposes of reporting
DO	dissolved oxygen
D/P	differential pressure
DSOD	Division of Safety of Dams
DWR	California Department of Water Resource
EA	Engineering Archive
EAM	Enterprise Asset Management
EAP	emergency action plan
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
EFWS	Emergency Firefighting Water System
EIR	environmental impact report
EOP	Emergency Operations Plan
ERP	emergency response plan
FHSZ	Fire Hazard Severity Zone
FIRO	Forecast Informed Reservoir Operations
FRP	fiberglass-reinforced plastic
FY	fiscal year (July to June the following year)
GCSD	Groveland Community Services District
GDR	Geotechnical Data Report

GIR	Geotechnical Investigation Report
GIS	geographic information system
gpm	gallons per minute
GSU	generator step-up
HAA5	haloacetic acids
HHWP	Hetch Hetchy Water and Power
HTWTP	Harry Tracy Water Treatment Plant
HVAC	heating, ventilation, and air conditioning
I-680	Interstate 680
ICS	Incident Command System
IFR	instream flow release
IPS	iron pipe straight threaded plug
ISO	International Organization for Standardization
IT	Information Technology
JOC	job order contract
KP-OS	Kirkwood Powerhouse to O'Shaughnessy
kV	kilovolt
kVa	kilovolt-ampere
LCA	Lower Cherry Aqueduct
LCRR	Lead and Copper Rule Revision
LCSD	Lower Crystal Springs Dam
LCSR	Lower Crystal Springs Reservoir
LLNL	Lawrence Livermore National Laboratory
LMPS	Lake Merced Pump Station
LOF	likelihood of failure
LOS	level of service
MCC	motor control center
MCL	maximum contaminant level
M/DBP	microbial/disinfection byproduct
MG	million gallons
mgd	million gallons per day
µg/L	micrograms per liter
MID	Modesto Irrigation District
MW	megawatt
N/A	not applicable
NAR	Needs Assessment Report

NCSBPL	New Crystal Springs Bypass Pipeline
NCSBT	New Crystal Springs Bypass Tunnel
NEPA	National Environmental Policy Act
NIT	New Irvington Tunnel
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRLMD	Natural Resources and Lands Management Division
O&M	operations and maintenance
OCB	oil circuit breaker
PAC	powdered activated carbon
PAPL	Palo Alto Pipeline
PCCP	prestressed concrete cylinder pipe
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PG&E	Pacific Gas and Electric Company
PIL	Pilarcitos Dam
PLC	programmable logic controller
PM	preventive maintenance
PMF	probable maximum flood
ppb	parts per billion
PRV	pressure-relief valve
psi	pounds per square inch
PSPS	public safety power shutoff
Pulgas PS	Pulgas Pump Station
PVC	polyvinyl chloride
R&R	rehabilitation and replacement
RCCCP	Regional Cross-Connection Controls Project
RCP	reinforced concrete cylinder pipe
RGSR	Regional Groundwater Storage and Recovery
RMU	remote monitoring unit
ROV	remotely operated vehicle
ROW	right-of-way
RRA	risk and resilience assessment
RWS	Regional Water System
SABPL	San Antonio Backup Pipeline

SAMP	Strategic Asset Management Plan
SAPL	San Andreas Pipeline
SAPS	San Antonio Pump Station
SCADA	supervisory control and data acquisition
SFBOS	San Francisco Board of Supervisors
SFPUC	San Francisco Public Utilities Commission
SFWD	San Francisco Water Department
SFWS	San Francisco Water System
SJPL	San Joaquin Pipeline
SMP	surface mining permit
SOP	standard operating procedure
sq. mi	square miles
SRWS	State of the Regional Water System
SSBPL	Sunset Branch Pipeline
SSPL	Sunset Supply Pipeline
SVCF	Sunol Valley Chloramination Facility
SVWTP	Sunol Valley Water Treatment Plant
SWRCB	State Water Resources Control Board
TBD	to be determined
T&O	taste and odor
TID	Turlock Irrigation District
TOSPL	Town of Sunol Pipeline
TSOV	turbine shut-off valve
TTF	Tesla Treatment Facility
UCMR4	Fourth Unregulated Contaminant Monitoring Rule
UCMR5	Unregulated Contaminant Monitoring Rule Fifth Round
UCSD	Upper Crystal Springs Dam
UCSR	Upper Crystal Springs Reservoir
UPS	uninterruptible power supply
U.S. EPA	United States Environmental Protection Agency
USFS	United States Forest Service
UV	ultraviolet
VFD	variable frequency drive
WE	(SFPUC) Water Enterprise
WEEAM	Water Enterprise, Enterprise Asset Management
WQD	Water Quality Division

WSA	Water Supply Agreement
WSAB	Wildfire Safety Advisory Board
WSIP	Water System Improvement Program
WSP	welded steel pipe
WSTD	Water Supply and Treatment Division

1. Introduction and Overview

1.1 Purpose of Report

This 2022 update of the State of the Hetch Hetchy Regional Water System (RWS) report conveys the state of the assets comprising RWS since the previous update in 2020. The report covers the period of fiscal years (FYs) 2020/21 and 2021/22 (July 2020 through June 2022). This duration is commonly referred to as the "reporting cycle" throughout this report.

This report is also used to meet a contractual requirement of the Amended and Restated Water Supply Agreement (WSA) of December 2018 between San Francisco Public Utilities Commission (SFPUC) and its wholesale water customers (Section 3.10B):

> San Francisco will submit reports to its retail and wholesale customers on the "State of the Regional Water System," including reports on completed and planned maintenance, repair, or replacement projects or programs, by September of every even-numbered year, with reports to start in September 2010.

The report is made available to customers and stakeholders and is frequently used internally for reference purposes and budget preparation.

1.2 System Overview

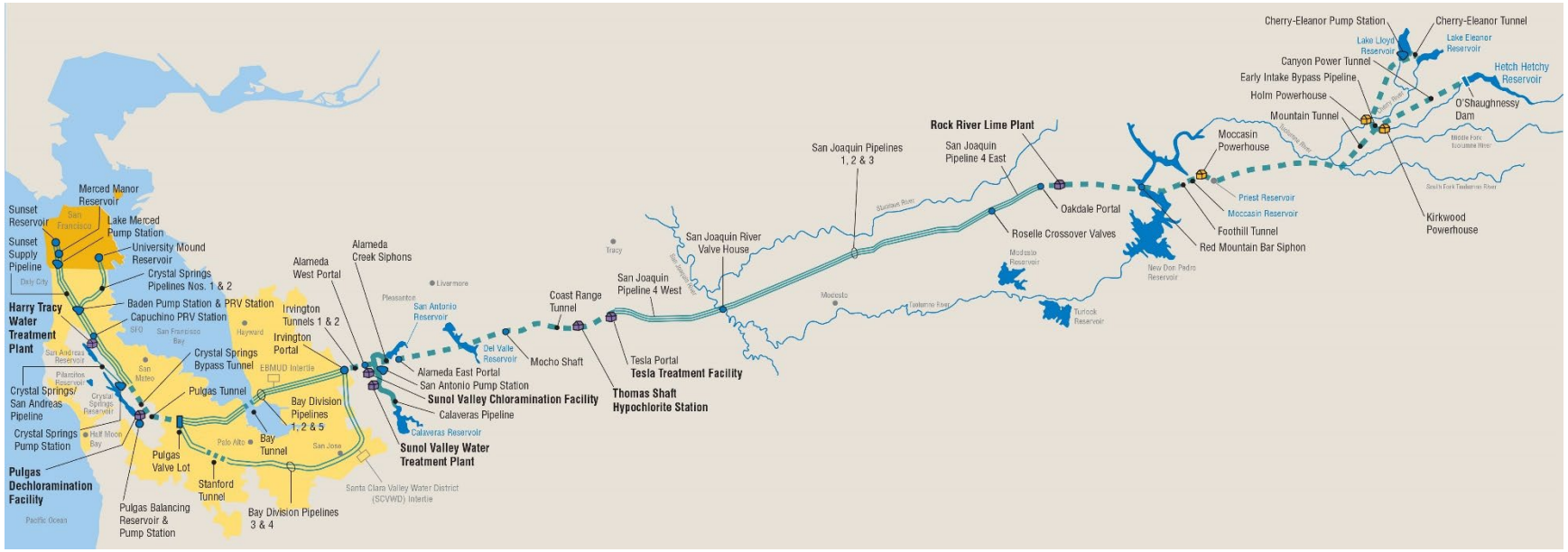
RWS, owned and operated by SFPUC, consists of a complex series of reservoirs, tunnels, pipelines, pump stations, treatment plants, and power generation and transmission assets that deliver water from Sierra Nevada and Bay Area watersheds to four counties in the Bay Area. RWS comprises two water systems that were developed independently but are operated as one. The first is *Hetch Hetchy Water*, which imports water from the Tuolumne River and generates hydropower as it is transported downstream. The second is *Regional Water*, originally developed by the Spring Valley Water Company and purchased by the City and County of San Francisco (CCSF) in 1930.

RWS provides primary water supply for approximately 2.7 million residential, commercial, and industrial customers in San Francisco, Santa Clara, Alameda, San Mateo, San Joaquin, and Tuolumne counties. On average, 15 percent of the water delivered to SFPUC customers is derived from runoff in the Alameda and Peninsula watersheds. The remaining 85 percent comes from Sierra Nevada snowmelt and precipitation via the Tuolumne River and related facilities.

RWS is shown on Figure 1-1 and spans from the Sierra Nevada to the San Francisco Bay Area. The system begins with three storage reservoirs: Hetch Hetchy Reservoir, Lake Eleanor, and Lake Lloyd.

Hetch Hetchy Reservoir relies on O'Shaughnessy Dam to impound water along the main stem of the Tuolumne River. The Hetch Hetchy watershed is entirely within Yosemite National Park; it is almost completely a federally designated wilderness area and is only accessible by permit. Water flows by gravity from Hetch Hetchy Reservoir to downtown San Francisco through a series of tunnels, regulating reservoirs, powerhouses, treatment facilities, and pipelines.

Figure 1-1: Schematic of the Hetch Hetchy Regional Water System



SFPUC's other two impounding reservoirs in the Tuolumne River basin, Lake Eleanor and Lake Lloyd (a.k.a. Cherry Lake), are used primarily to (1) satisfy downstream flow obligations to Turlock Irrigation District (TID) and the Modesto Irrigation District (MID); (2) maintain minimum instream flow releases below the reservoirs; (3) produce hydroelectric power at Holm Powerhouse; and (4) provide flows for recreational use (i.e., whitewater rafting).

Although Lake Eleanor and Lake Lloyd do not normally supply water directly to the Bay Area, water stored in these reservoirs is instrumental in preserving the Bay Area's water supply in Hetch Hetchy Reservoir. Release of water from these reservoirs can partially fulfill CCSF's inflow obligations to TID and MID, thereby allowing water to be captured and retained in Hetch Hetchy Reservoir for delivery to the Bay Area.

Lake Eleanor is approximately 3 miles above the confluence of Eleanor Creek and Cherry Creek. Lake Lloyd is situated on Cherry Creek, about 4 miles above the confluence with Eleanor Creek. Lake Eleanor and Lake Lloyd are linked by a tunnel and pump facility that allows water to be transferred from Lake Eleanor to Lake Lloyd. As a result of this linkage, the two reservoirs are generally operated as a single unit.

Water that is not released to the creeks below Lake Eleanor and Lake Lloyd is diverted through Cherry Power Tunnel to Holm Powerhouse. Holm Powerhouse is situated on Cherry Creek, about 1 mile upstream of its confluence with the Tuolumne River. Water can be diverted from Lake Lloyd through Holm Powerhouse and released into Cherry Creek, directly upstream of the confluence with the Tuolumne River. These releases also support CCSF's inflow obligations to TID and MID.

In drought conditions and with prior approval from the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), water from Lake Lloyd and Lake Eleanor can be diverted by Lower Cherry Diversion Dam to the Early Intake Diversion Structure on the Tuolumne River, where it would enter Mountain Tunnel to provide an alternative water source for consumption by RWS customers. When supplies from Lake Lloyd and Lake Eleanor are used, all diversions from the Tuolumne River must be filtered. These sources of upcountry, non-Hetch Hetchy water are collectively known as Upcountry Non-Hetch Hetchy Water Supply and were approved by DDW in permit amendment No. 5 in 2016.

Water from Hetch Hetchy Reservoir is conveyed through the Canyon Power Tunnel to Kirkwood Powerhouse, where it can be used to generate power. Water from Kirkwood Powerhouse is discharged into Mountain Tunnel via the Early Intake Bypass Tunnel and Pipeline. Deliveries to Groveland Community Services District (GCSD) in Tuolumne County are made from waters pumped from Mountain Tunnel. Mountain Tunnel then conveys Hetch Hetchy water to Priest Reservoir, a regulating reservoir. From Priest Reservoir, water enters the Moccasin Power Tunnel and passes through Moccasin Powerhouse, again generating power. Water from Moccasin Powerhouse is discharged directly to Moccasin Reservoir. The state-operated Moccasin Fish Hatchery diverts up to 30 cfs from Moccasin Reservoir.

Water stored in Priest and Moccasin reservoirs is entirely from Hetch Hetchy Reservoir and is isolated from the surrounding watersheds by open canals, diversions, and pipelines. Local runoff that would normally flow into Priest and Moccasin reservoirs is diverted around the reservoirs and eventually discharges to Don Pedro Reservoir.

After Moccasin Reservoir, the water supply enters Foothill Tunnel via the Moccasin Reservoir Bypass or the Moccasin Gate Tower. The water is treated at the Rock River Lime Plant, along the Foothill Tunnel, to adjust the pH of the water supply by injecting slaked lime (calcium hydroxide). Foothill Tunnel terminates at Oakdale Portal, where the San Joaquin Pipelines (SJPLs) begin.

The SJPLs are three complete pipelines that cross the Central Valley, connecting Foothill Tunnel to the Coast Range Tunnel (CRT). Two additional sections of SJPL (SJPL No. 4 East and SJPL No. 4 West) allow redundancy at the ends of the SJPLs. Crossover facilities (Emery, Pelican, and Roselle) allow transfer of water between pipelines, increasing system resiliency. Throttling stations on SJPL Nos. 2 and 3, in conjunction with the crossovers, allow for any flow target between 80 and 305 million gallons per day (mgd). At the San Joaquin River Valve House, pressure-reducing valves provide pressure relief for the system and a means of drainage at the low point of the pipeline. The SJPLs terminate at the Tesla Valve House, where the water is treated at the Tesla Treatment Facility (TTF). At TTF, water is exposed to ultraviolet (UV) light, pH is adjusted, fluoride is added, and primary disinfection begins with the addition of chlorine.

Water then enters CRT, a 26-mile tunnel terminating at the Alameda East Portal (AEP) in the Sunol Valley in Alameda County. There is a backup disinfection station at Thomas Shaft, approximately 4.5 miles downstream of Tesla Portal. Water traveling through CRT is considered appropriately disinfected upon reaching AEP. AEP is considered the point of entry for the unfiltered Hetch Hetchy supply, in accordance with the RWS drinking water permit.

At AEP, Hetch Hetchy water is split among the four Alameda Siphons that cross the Calaveras Fault and Alameda Creek. Water then flows to the Sunol Valley Chloramination Facility (SVCF), where chlorine is boosted and ammonia is added in the Alameda Siphons to form chloramines. Sodium hydroxide is also added at SVCF to maintain optimal pH levels. Water then continues to the Alameda West Portal (AWP), where it enters the 3.5-mile Irvington Tunnels (Nos. 1 and 2). Hetch Hetchy water can also be diverted to San Antonio Reservoir or the Sunol Valley Water Treatment Plant (SVWTP). The Calaveras and San Antonio Reservoirs collect local runoff from their surrounding watersheds, which adds to the overall water supply of RWS. All local reservoir water in the East Bay is conveyed to SVWTP, where it is treated prior to entering the Alameda Siphons.

From the Irvington Tunnels, the blend of unfiltered Hetch Hetchy water and water treated at SVWTP is split into the five Bay Division Pipelines (BDPLs) at Irvington Portal in Fremont. BDPL Nos. 1, 2, and 5 continue west from the Irvington Tunnels, combining into the Bay Tunnel under San Francisco Bay from Newark to the Ravenswood area, then again splitting flows into BDPL Nos. 1, 2, and 5 to the Pulgas Tunnel west of Redwood City. The Bay Tunnel was commissioned in 2014, replacing two existing underwater pipelines. BDPL Nos. 3 and 4 travel south from Irvington Portal and follow the southern shore of San Francisco Bay through Santa Clara, Sunnyvale, Mountain View, Palo Alto, and Stanford to the Pulgas Tunnel just west of Redwood City, where all five pipelines meet. Water in the Pulgas Tunnel continues to flow north to the Crystal Springs Bypass Tunnel to meet demands on the Peninsula; when demand is low, water is either pumped into the Pulgas Balancing Reservoir for storage or flows into Upper Crystal Springs Reservoir (UCSR) after being dechloraminated at the Pulgas Dechloramination Facility.

The Palo Alto Pipeline is supplied by BDPL Nos. 1, 2, and 5, and supplies water south from Redwood City to Palo Alto, Stanford, and Menlo Park.

North of the Crystal Springs bypass facilities, Hetch Hetchy/SVWTP water is transmitted along the Peninsula into CCSF's low-pressure zone system via the Sunset Supply Pipeline (SSPL) and Crystal Springs Pipeline (CSPL) Nos. 1, 2, and 3. The terminal storage for low-pressure zone water consists of the University Mound Reservoir in San Francisco, which is supplied from CSPL Nos. 1 and 2. SSPL low-pressure zone water is transmitted north along the Peninsula to the Lake Merced Pump Station (LMPS) in San Francisco, where it is pumped into the high-pressure zone. Water from LMPS either serves demands directly or is stored in Sunset Reservoir and Sutro Reservoir in San Francisco.

San Mateo Creek watershed runoff is captured in Lower Crystal Springs Reservoir (LCSR) and UCSR. Pilarcitos Creek watershed runoff is routed to LCSR for storage. Water from LCSR is transferred to San Andreas Reservoir through the Crystal Springs Pump Station (CSPS) and Crystal Springs-San Andreas Pipeline (CSSAPL). Harry Tracy Water Treatment Plant (HTWTP) draws from San Andreas Reservoir for supply and produces high-pressure zone water. Treated water from HTWTP is transmitted through San Andreas Pipeline (SAPL) Nos. 2 and 3 and the Sunset Branch Pipeline. SAPL Nos. 2 and 3 reach high-pressure zone reservoirs in San Francisco. The Sunset Branch Pipeline connects high-pressure zone to low-pressure zone water in SSPL through a pressure-reducing valve at the Capuchino Valve Lot in Millbrae. In Colma, at the San Pedro Valve Lot, SAPL No. 3 is interconnected with SSPL; north of this point, it is used for low-pressure zone water transmission to Merced Manor Reservoir. (This replaces the function previously provided by the abandoned Baden-Merced Pipeline.) Baden Pump Station allows low-pressure zone water from CSPL No. 2 to be pumped to each high-pressure zone pipeline. Baden Pump Station can also be used to transfer high-pressure zone water into the low-pressure zone pipelines. These inter-zone connections accomplished through the Water System Improvement Program (WSIP) at San Pedro Valve Lot, Baden Pump Station, and Capuchino greatly increase operational flexibility, particularly during construction work and emergencies.

The Pilarcitos watershed and reservoir is used to partially supply the Coastside County Water District, and also to supply RWS via inter-basin transfers.

A major upgrade of RWS facilities began in 2002,[1] with the initiation of WSIP. Most of the projects are completed, and the program is 98 percent complete. As of June 2022, two regional projects remain to be completed. WSIP has significantly increased the reliability of the water system.

Thirteen groundwater wells in northern San Mateo County that were installed for WSIP will produce supplemental dry-year water supply to RWS as part of a SFPUC conjunctive-use project with the cities of Daly City and San Bruno, and the California Water Service Company (Cal Water), which serves South San Francisco and Colma. Six groundwater wells in San Francisco will produce up to 4 mgd of groundwater for retail delivery in San Francisco, helping offset some of San Francisco's demand from RWS.

[1] SFPUC approved the Long-Term Strategic Plan and the Capital Improvement Program (CIP) in May 2002, followed by voter approval of revenue bond authority in November 2002. The first WSIP description (then referred to as the CIP) was submitted to the state in February 2003.

1.3 Water Enterprise Management Structure

RWS is owned and operated by SFPUC, a department of CCSF, and serves both retail and wholesale customers in four counties in the Bay Area. SFPUC is responsible for the operations, maintenance, and development of three utility enterprises: Water, Wastewater, and Power. The Water Enterprise (WE) manages RWS through two large Operating Divisions that report to the Assistant General Manager, Water: Hetch Hetchy Water and Power (HHWP) and Water Supply and Treatment Division (WSTD).

HHWP manages the *Hetch Hetchy Water* portion of RWS from the source of the system in the Sierra Nevada to AEP. Additionally, HHWP operates and maintains SFPUC's power generation and transmission system from its upcountry powerhouses in the Sierra Nevada across the valley to Newark.

WSTD manages the *Regional Water* portion of RWS from AEP at the end of CRT, through the wholesale service area, to terminal reservoirs in San Francisco. Additionally, WSTD operates and maintains multiple water treatment facilities to treat water from the Hetch Hetchy, Alameda Watershed, and Peninsula Watershed supplies.

In addition to the two abovementioned Operating Divisions, WE includes the Natural Resources and Lands Management Division (NRLMD), the Water Quality Division (WQD), the Water Resources Division (WRD), and the City Distribution Division (CDD).

NRLMD is responsible for operations and maintenance (O&M) of SFPUC-owned watershed and right-of-way (ROW) lands in the East Bay and Peninsula, and environmental regulatory compliance for WE O&M activities.

WQD provides laboratory services, compliance/operational monitoring, process engineering, regulatory reporting, water quality inquiry/complaint response, and technical support for both HHWP and WSTD in the operation of RWS.

WRD is responsible for diversifying San Francisco's water supply portfolio through a number of programs, including water conservation, groundwater, recycled water, and onsite water recycling. WRD also evaluates new projects that will help meet future water supply needs in the SFPUC service area, such as groundwater banking, surface water storage expansion, water transfers, purified water, and desalination, as well as technological innovations and other tools that can increase supply or reduce demand.

CDD is an Operating Division responsible for O&M of San Francisco's four active water systems: the Potable System, which includes reservoirs and pump stations; the Groundwater System; the Recycled Water System; and the Emergency Firefighting Water System.

1.4 Organization of Report

The State of the Regional Water System (SRWS) is best communicated by the state of the assets that it comprise. For this reason, the SRWS Report is strategically organized to communicate maintenance, capital, and regulatory work that is accomplished to maintain a sustainable RWS for customers that it serves. Report organization is summarized in Table 1-1.

Table 1-1: Organization of SRWS Report

Section	Core Focus
1	Defines purpose of the SRWS Report and provides an overview of the system and management structure
2	Provides an overview of asset management policies and capital planning business processes that are in place to manage the system
3	Reports on the progress that WE made during reporting cycle on its implementation of the Asset Management Policy
4	Is organized by asset type, providing a detailed report on asset maintenance and condition, as well as relevant capital improvement projects
5	Summarizes the regulators that have jurisdiction over the operation of portions of RWS, and any inspections or activities that occurred during this reporting cycle
6	Presents potential emerging issues tracked by SFPUC that may have significant impacts to operations and maintenance of RWS

Notes:

RWS = Regional Water System
SFPUC = San Francisco Public Utilities Commission
SRWS = State of the Regional Water System
WE = Water Enterprise

2. Asset Management Policy and Capital Planning Process

SFPUC has an Asset Management Policy and Capital Planning Process, which is implemented by WE. The policy and process work in tandem to produce a sustainable management structure that supports WE's ability to achieve its LOS goals and objectives. Building on this foundation, WE developed and mapped specific asset management objectives to the Asset Management Policy; thus, establishing an architecture for management of WE assets.

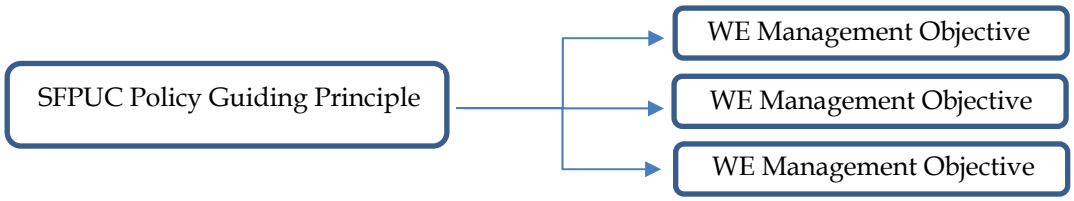
2.1 Asset Management Policy

The SFPUC Asset Management Policy (SFPUC Policy) guides the planning, design, procurement, construction, operation, maintenance, and retirement of critical infrastructure. Adopted by SFPUC in December 2020, it outlines SFPUC's commitment and approach to managing its diverse portfolio of assets in a manner that maximizes life-cycle value of assets while consistently meeting level of service (LOS) and performance goals, as well as driving evidence-based decision making. At the heart of the policy exists a set of "Guiding Asset Management Principles" that serve as the backbone of WE's Asset Management strategy. WE's implementation of the SFPUC Policy is discussed in Section 2.1.1, and its "Guiding Asset Principles" are summarized in Table 2-1.

2.1.1 Water Enterprise's Implementation of the SFPUC Asset Management Policy

Since the SFPUC Policy was adopted, WE has worked on an implementation strategy that maps specific, measurable asset management objectives to the "Guiding Asset Management Principles" that were defined in the SFPUC Policy. As illustrated on Figure 2-1, each SFPUC guiding principle may have multiple objectives defined by WE that, once achieved, will bring its Asset Management in alignment with the SFPUC Policy.

Figure 2-1: Mapping Each SFPUC Asset Management Guiding Principle to Multiple Asset Management Objectives for the Water Enterprise



The implementation strategy serves as a multi-year road map that will achieve consistency across WE. The rate of implementation will be specific to each Operating Division and will be heavily influenced by available resources and competing operational priorities. Section 3 provides updates on each asset management objective, highlighting WE's accomplishments and achievements as it works toward full implementation of the SFPUC Policy.

Table 2-1: Summary of SFPUC Asset Management Guiding Principles and Water Enterprise's Asset Management Objectives

Guiding Asset Management Principle	SFPUC Principle Description	Water Enterprise Objectives
Asset Risk Management	Develop and implement a risk management methodology that integrates understanding of risk across all asset classes and facilities.	See 2.1.1.1
Asset Management and Maintenance Roles and Responsibilities	Establish organizational roles, responsibilities, and accountability, at the Enterprise and Bureau levels, across the various asset classes, for the management of the life cycle of the assets.	See 2.1.1.2
Asset Management Objectives	Establish, publish, and regularly review asset management objectives to guide capital and maintenance planning. The objectives provide the necessary detail to connect daily workforce priorities with the broader policy goal and LOS.	See 2.1.1.3
Asset Registry	Maintain a detailed asset inventory in CMMS and/or GIS.	See 2.1.1.4
Asset Condition	Perform periodic asset condition assessments and determine actual performance as related to LOS.	See 2.1.1.5
Operations and Maintenance Strategies	Develop and implement reliability-centered, preventive, and corrective maintenance programs, across all asset classes, based on condition assessment findings and asset criticality.	See 2.1.1.6
Asset Investment Strategies	Incorporate asset management findings into operating and capital budgets. Develop capital projects that directly address gaps in asset performance relative to established LOS and performance metrics.	See 2.1.1.7
Budgeting	Develop budgets for all prioritized work; identify implementable funding plans in collaboration with SFPUC Finance.	See 2.1.1.8
Performance Monitoring	Evaluate asset performance; investigate asset incidents and failures; and record available asset data for use in reviewing asset management objectives, updating the asset registry, assessing asset conditions, and informing operations and maintenance strategies and asset investment strategies.	See 2.1.1.9
LOS	Establish, publish, and regularly review LOS goals and objectives, and related performance objectives.	See 2.1.1.10

Notes:

CMMS = Computerized Maintenance Management System
GIS = geographic information system
LOS = level of service
SFPUC = San Francisco Public Utilities Commission

2.1.1.1 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Risk Management

SFPUC Guiding Principle Description. Develop and implement a risk management methodology that integrates understanding of risk across all asset classes and facilities.

Objectives

- Develop a Risk Framework that standardizes the use of consequence of failure (COF) and likelihood of failure (LOF) as the main drivers for determining system risk throughout WE.
- Maintain emergency response plans (ERPs) for all WE Divisions.
- Further develop and maintain a risk register in a computerized maintenance management system (CMMS), including a score for COF, LOF, and Risk.

2.1.1.2 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Management and Maintenance Roles and Responsibilities

SFPUC Guiding Principle Description. Establish organizational roles, responsibilities, and accountability, at the Enterprise and Bureau levels, across the various asset classes, for the management of the life cycle of the assets.

Objectives

- Develop an asset change management process.
- Develop WE and Division-level matrices to clearly outline roles and responsibilities for asset management and O&M staff.

2.1.1.3 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Management Objectives

SFPUC Guiding Principle Description. Establish, publish, and regularly review asset management objectives to guide capital and maintenance planning. The objectives provide the necessary detail to connect daily workforce priorities with the broader policy goal and LOS.

Objectives

- Establish Asset Management Objectives for WE that map back to SFPUC's Asset Management Policy.
- Review the objectives to meet the system's operational needs at least once every 2 years.
- Report on the status of the Asset Management Objectives once every 2 years.

2.1.1.4 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Registry

SFPUC Guiding Principle Description. Maintain a detailed asset inventory in CMMS and/or geographic information system (GIS).

Objectives

- Continue to develop and maintain a detailed asset registry with increased standardization and uniformity across WE (asset classification, subclassification, specifications, and taxonomy).
- Develop a shared definition of an "asset" throughout WE.
- Continue to use and standardize location and functional/location hierarchies within CMMS and GIS.
- Develop and maintain a GIS database for WE's linear assets.

2.1.1.5 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Condition

SFPUC Guiding Principle Description. Perform periodic asset condition assessments and determine actual performance as related to LOS.

Objectives:

- Complete planned and scheduled asset condition assessments that inform maintenance, investment, and risk mitigation strategies.
- Prioritize condition assessments to increase system reliability.

2.1.1.6 Water Enterprise's Implementation of the Asset Management Guiding Principle: Operations and Maintenance Strategies

SFPUC Guiding Principle Description. Develop and implement reliability-centered, preventive, and corrective maintenance programs, across all asset classes, based on condition assessment findings and asset criticality.

Objectives:

- Develop a Strategic Asset Management Plan (SAMP) and individual Asset Management Plans (AMPs).
- Establish the ability to use CMMS to demonstrate compliance with federal, state, and local regulatory requirements.
- Demonstrate proper stewardship of environmental resources under SFPUC control through the use of CMMS reporting.

2.1.1.7 Water Enterprise's Implementation of the Asset Management Guiding Principle: Asset Investment Strategies

SFPUC Guiding Principle Description. Incorporate asset management findings into operating and capital budgets. Develop capital projects that directly address gaps in asset performance relative to established LOS and performance metrics.

Objectives:

- Use asset management data to develop expenditure reports that compile costs for facilities, assets, and maintenance programs.
- Develop and implement a replacement planning approach to estimate asset useful life, renewal, and replacement requirements and costs.
- Design future facilities based on information gathered through the asset management program.

2.1.1.8 Water Enterprise's Implementation of the Asset Management Guiding Principle: Budgeting

SFPUC Guiding Principle Description. Develop budgets for all prioritized work; identify implementable funding plans in collaboration with SFPUC Finance.

Objectives:

- Update the 10-Year Capital Improvement Program (CIP) and annual operating budget by integrating data from condition assessments, estimates of remaining useful life, failure analyses, replacement costs, maintenance programs, and LOS into a well-informed forecast of Capital and Rehabilitation and Replacement (R&R) Program costs.
- Develop expenditure reports that compile costs for facilities, assets, and maintenance programs—a quick way to tell where money is going and what it is accomplishing.

2.1.1.9 Water Enterprise's Implementation of the Asset Management Guiding Principle: Performance Monitoring

SFPUC Guiding Principle Description. Evaluate asset performance; investigate asset incidents and failures; and record available asset data for use in reviewing asset management objectives, updating the asset registry, assessing asset conditions, and informing O&M strategies and asset investment strategies.

Objectives:

- Formalize asset failures analysis and root cause analysis across WE.
- Complete peer reviews of maintenance programs to ensure that the scope of maintenance is consistent with industry standards and create opportunities to increase standardization and uniformity across the WE, Enterprise Asset Management (WEEAM) Programs.
- Establish and maintain Key Performance Indicators to track planning and scheduling, asset, and asset management efficiency and effectiveness.

2.1.1.10 Water Enterprise's Implementation of the Asset Management Guiding Principle: Levels of Service

SFPUC Guiding Principle Description. Establish, publish, and regularly review LOS goals and objectives, and related performance objectives.

Objectives:

- Review LOS goals and objectives every odd year.

See Section 2.1.2 for WE's LOS Objectives

2.1.2 Level of Service History and Objectives

In 2008, SFPUC Adopted LOSs for WE in conjunction with the approval of the WSIP Programmatic Environmental Impact Report. Those LOSs provided the basis for many WSIP project designs and are presented below.

As an update, the LOS language was reviewed and modified on June 2, 2021 (see Appendix E for the draft version). The modified version has not been considered for adoption.

The adopted LOS goals and objectives from 2008 are presented in the following sections.

2.1.2.1 Water Quality – Maintain High Water Quality

System Performance Objective:

- Design improvements to meet current and foreseeable future federal and state water quality requirements.
- Provide clean, unfiltered water originating from Hetch Hetchy Reservoir, and filtered water from local watersheds.
- Continue to implement watershed protection measures.

2.1.2.2 Seismic Reliability – Reduce Vulnerability to Earthquakes

System Performance Objective:

- Design improvements to meet current seismic standards.
- Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for design of the regional system is 229 mgd. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively.
- Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.

2.1.2.3 Delivery Reliability – Increase Delivery Reliability and Improve Ability to Maintain the System

System Performance Objective:

- Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service.
- Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages.
- Provide operational flexibility and system capacity to replenish local reservoirs as needed.
- Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance, concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.

2.1.2.4 Water Supply – Meet Customer Water Needs in Nondrought and Drought Periods

System Performance Objective:

- Meet an average annual non-drought-year system water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers through 2018.
- Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.
- Diversify water supply options during nondrought and drought periods.
- Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

2.1.2.5 Sustainability – Enhance Sustainability in all System Activities

System Performance Objective:

- Manage natural resources and physical systems to protect watershed ecosystems.
- Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat.
- Manage natural resources and physical systems to protect public health and safety.

2.1.2.6 Cost-Effectiveness – Achieve a Cost-Effective Fully Operational System

System Performance Objective:

- Ensure cost-effective use of funds.
- Maintain a gravity-driven system.
- Implement regular inspection and maintenance program for all facilities.

2.2 Capital Planning Process

WE identifies and prioritizes the capital investments that are required to keep RWS in reliable operating condition. SFPUC Infrastructure implements the approved capital improvement programs (CIP) and projects for the three enterprises of SFPUC, including WE. An overview of how the WE manages the planning, prioritization, and optimization of its CIP is summarized in this section of the SRWS Report.

2.2.1 Capital Planning Process Overview

Capital projects that support RWS are organized into two 10-year CIPs—the Hetch Hetchy Water CIP and the Regional Water CIP—that are adopted by SFPUC and integrated into SFPUC's Financial Plan and rate-setting calculations. Major updates to the CIP generally happen every 2 years, in coordination with the overall budget process; however, annual updates may be required. The Hetch Hetchy Water CIP includes capital improvements to assets that are operated and maintained by HHWP. Similarly, the Regional Water CIP includes capital improvements to assets that are operated and maintained by WSTD, WQD, and NRLM.

The Capital Planning Process results in 10-year Capital Plans that are submitted to SFPUC and then San Francisco Board of Supervisors (SFBOS) for approval. The objectives for the capital plans are that they are (1) aligned with each Operating Division's priorities; (2) reviewed to confirm that adequate staffing and contracting resources are available to implement; and (3) considered "affordable," based on meeting annual budget targets set by Finance. The Capital Planning Process generally includes (1) identification of candidate capital projects; (2) development of scopes, schedules, and budget estimates; and (3) confirmation of deliverability.

2.2.1.1 Identification of Candidate Capital Projects

Each of WE's Operating Divisions is responsible for identifying candidate capital projects based on asset management data, regulatory requirements, emerging needs, and specific program goals or objectives (such as Alternative Water Supply projects). Data used to identify candidate projects vary but may include condition, age, operational performance, regulatory requirements, technology improvements, and estimated remaining life. Once identified, a list of candidate projects is produced for each Operating Division so that estimates may be developed for the candidate projects' scope, schedule, and budget.

2.2.1.2 Development of Scope, Schedule, and Budget Estimates

For preparation of the 10-year CIPs, both active projects and new candidate projects undergo a project development and confirmation process that either updates or establishes scope, schedule, and budget for each project prior to advancing to the deliverability review.

New Candidate Projects

To confirm the project's scope, schedule, and budget for a new candidate project, a multi-discipline team is assembled from WE's Operating Divisions and Infrastructure. Led by the Operating Division, the team discusses the need for the project and develops a basic scope of work that can be used to establish an initial schedule and budget. Infrastructure then leads the team to create a schedule and budget for the project.

The budget developed for a new candidate project usually does not have much project maturity (typically less than 2 percent of project definition) and is often the result of assessment or inspection work that was recently completed by the WE operations divisions. Because the project definition is low at this stage of the project, the cost estimates carry ranges and contingencies that are commensurate with the level of information on which they were based. Cost estimates are typically treated as Class 5 estimates, according to the Association for the Advancement of Cost Engineering International (AACEI) guidelines, and carry a range of -50 percent to +100 percent. Additionally, built into the initial estimates are contingencies for design and reserves for unknowns. Lastly, the estimates include assumptions for escalation, which are calculated to the midpoint of construction once a schedule is determined.

Similar to the budget, the initial schedule for a new candidate project is developed collaboratively between the WE's Operating Divisions and Infrastructure. Under Infrastructure's leadership, the initial schedule for a new candidate project is developed by identifying the phases and deliverables that are expected for the project. Infrastructure applies its experience to identify the durations for each of the phases and milestones, and build up a draft of the initial schedule. The Operating Division may identify potential system outage constraints, including durations and boundaries, and the project's construction schedule is adjusted as appropriate. It is noted that this exercise may impact the project's cost estimate because the mid-point of construction may change, resulting in a change in the escalation part of the cost estimate.

Once candidate projects have scopes, schedules, and budgets established, they are entered into a capital planning database (SFPUC is currently using Unifier software) so they can be further evaluated based on the Operating Divisions' priorities, the funding available, and Infrastructure's resources.

Active Capital Projects

Unlike new candidate projects, active projects were approved in previous capital plans and have a moderate to strong project maturity level. The project teams have improved information, such as completed planning documents (e.g., Alternatives Analysis Report [AAR]) or partial design submittals (e.g., 35% Detailed Design) to advance the project's schedule and budget. Also to the benefit of the active projects is a Project Controls team that works closely with Project Managers to track the health of the project in a quantitative manner that produces data for capital planning and reporting purposes.

Using data provided by the Project Controls team, the budget and schedule for each active project is reviewed by a multi-discipline team from WE's Operating Divisions and Infrastructure, similar to the team that was assembled to vet new candidate projects. The project budget and schedule are prepared using a detailed nine-project-phase structure. The structure includes (1) project management; (2) planning; (3) environmental; (4) ROW; (5) design; (6) bid and award; (7) construction management; (8) construction; and (9) closeout, and each phase is evaluated for overruns and underruns using earned value management principles.

The active project budgets account for contingencies and reserves; however, the ranges and percentages of contingencies are reduced compared to those used for new candidate projects, in a manner commensurate with the project's maturity level. Cost estimates follow the guidelines

of AACEI and typically include estimates from Class 4 through Class 1 as the project matures from the conceptual level to a complete design ready for advertisement.

Additionally, the outage assumptions for each active project are reviewed by WE's Operating Divisions, and adjustments are made to the project's scope, schedule, and budget if necessary. Because large capital projects typically span multiple years, outage assumptions for each active capital project are reviewed with each CIP development cycle. This review is completed to determine whether the previously documented outage assumptions remain valid, recognizing that operational circumstances can change over long periods of time (years) for a host of reasons that range from emergency repairs to extreme drought or flood.

At the end of this exercise, the active project's budget and schedule is adjusted accordingly and updated into Unifier so it can be further evaluated side by side with the new candidate projects for deliverability and priority.

2.2.1.3 Confirmation of Deliverability

For all active projects managed by Infrastructure, each bureau within Infrastructure (Project Management Bureau; Engineering Management Bureau; Construction Management Bureau; Environmental Management; Project Controls; and Infrastructure Business Management, including Contracts Administration and Workforce Development) reviews each project to confirm that resources are and will continue to be available to support each project. First, the availability of project team leaders is confirmed by reviewing assignments for Project Manager, Project Engineer, Resident Engineer, Environmental Project Manager, and Project Controls Engineer. This is performed by Bureau Managers, who confirm that leadership is in place and that team leaders have adequate availability for each project. The remaining resources needed for the project are then evaluated. This is generally performed by reviewing the project's budget for soft costs and comparing it to the schedule for the planning, design, and construction phases. The number and classifications of staff are estimated from the budgets (such as the number of engineers for each discipline needed for design of each project) for each phase of the work. Then Bureau Managers total the staff estimates and compare them to current staffing levels to determine whether existing staffing is available to successfully implement the projects according to the planned budgets and schedules.

If internal (SFPUC) resources are not available to execute projects, outside resources from other San Francisco Chapter 6 departments (CCSF departments that perform construction projects), such as the San Francisco Department of Public Works, are offered the opportunity to support the projects. If no Chapter 6 department has the necessary resources available, professional service contracts are considered and confirmed. For each active project, it is determined whether professional service contracts are needed for planning, design, or construction management support. Existing contracts are identified for availability, reserving a portion of each contract's authority for relevant designated projects. Identification of new contracts and inclusion of the contract procurement timeline during project planning is important, especially for professional services contracts, because procurement may take up to one year. Future potential contracts are identified by Project and Bureau Managers and communicated to Contracts Administration staff, who support the procurement process; Contracts Administration workloads are evaluated on an 18- to 24-month look-ahead basis to accommodate future contracting needs.

Active projects maintain detailed Project Management Plans that are updated whenever the project moves to a new phase. Key project leaders are listed, and resource requirements are detailed for the current phase. This is a useful tool for confirming deliverability as the project progresses.

During the capital planning process, new and candidate projects are not evaluated for deliverability until after the existing active projects are confirmed. Then candidate projects can be added into the deliverability review to see if there is sufficient resource capacity to initiate new projects. Infrastructure may comment back to WE that resources are or are not available to initiate the new project, in which case the project may be delayed or deferred until resources can be made available.

2.2.2 Capital Prioritization Process Overview

New candidate projects and active projects are uploaded into a master database with the scope, schedule, and budget that was developed during the previous steps of the planning process. The database also includes narratives for justification and statements of impact to operations. Projects are then assigned a criticality ranking based on criteria and methodologies specific to each of WE's Operating Divisions. The criticality ranking is based on multiple factors, which include:

- active project versus new candidate project;
- remaining useful life and LOF of the asset(s);
- COF;
- contribution to LOS goals and objectives;
- project impacts to other projects within 10 years;
- regulatory requirements;
- environmental and community benefits;
- safety to the public and SFPUC personnel; and
- financial impacts.

Using a scoring system, WE staff meet to score projects, developing a criticality score for the project and the overall ranking for all projects. The criticality ranking is used to inform choices about which projects to assign financial, staffing, and contracting resources.

2.2.3 Optimizing and Balancing the 10-Year Capital Improvement Plan

Once the projects are vetted, resources confirmed, and priorities set, the same multi-discipline team from both WE and Infrastructure begin the process of balancing the 10-year CIP to the financial targets established by Finance. Several iterations and refinements of the CIP master schedule are necessary between WE, Infrastructure, and Finance staff to balance CIP priorities, financial projections, strategic planning, management considerations, and operational needs. Iterations and refinements may include adjusting scopes and schedules to bring the 10-year CIP within financial targets.

In addition to adjusting the project's scopes and schedules, the team also looks for creative solutions to optimize the capital plan. The goal of the optimization process is to reduce system risk while still meeting targets set by the Finance. Optimization concepts typically include (1) leveraging WE's Operating Divisions' R&R teams to complete small projects to accommodate

deferment of large capital projects; (2) partially encumbering large construction contracts over multiple years to reduce the amount of unspent funds in a single FY; (3) identifying alternate resource plans to improve deliverability; and (4) realigning budgets from projects that are forecast to underspend or have closed.

3. Asset Management Program Status

WE remains focused on meeting the LOS goals and objectives while applying strategic asset management tactics that minimize operating costs and system risks to benefit the rate payers. Section 2.1 presented the multi-year Asset Management strategy adopted by SFPUC in 2020, which will achieve consistency across the entire WE while also aligning its Asset Management practices with the SFPUC policy. Recognizing that this is a multi-year effort, WE made significant progress this reporting cycle to advance its Asset Management business practices.

3.1 Asset Risk Management

Objective #1 – *Develop a Risk Framework that standardizes the use of COF and LOF as the main drivers for determining system risk throughout WE.*

> **Status and Update:** WE is in the process of transitioning to a risk-based capital planning strategy that will leverage its asset management data to forecast and prioritize future capital projects. The strategy involves summarizing WE into discrete groups of assets, establishing a probability of failure based on age and condition, and estimating a cost for replacement. When such a model is fully developed, WE will have the ability to communicate risks associated with the acceleration or deferment of capital investments, allowing for the opportunity to optimize its capital planning efforts.

Objective #2 – *Maintain ERPs for all WE Divisions.*

> **Status and Update:** WE has ERPs in place for all of its regulated dams. The California Governor's Office of Emergency Services (Cal OES) has either approved or is reviewing all ERPs that are currently in place, and WE will continue to coordinate with Cal OES until all are approved. HHWP also maintains a staff that is trained in the Incident Command System (ICS), with key staff having pre-deployed emergency response materials to improve efficiency immediately following an event. WSTD and NRLMD staff are also trained in ICS.

Objective #3 – *Further develop and maintain a risk register in CMMS, including a score for* COF, LOF, *and Risk.*

> **Status and Update:** WE is working toward a risk framework that will eventually be used to assign scores to each of its assets in Maximo. HHWP, WSTD, and NRLMD are at various stages of development on this objective. HHWP has a risk framework in place and is beginning to implement the framework for capital planning purposes. WSTD intends to develop a similar framework, but risk scores for assets in Maximo will be tackled at a future date after more foundational asset management building blocks are completed or improved. NRLMD did not make progress on this objective during this reporting cycle.

3.2 Asset Management and Maintenance Roles and Responsibilities

Objective #1 – *Develop an asset change management process.*

> **Status and Update:** WE divisions maintain a complex, diverse, and ever-evolving portfolio of assets. Continual process improvement is critical to ensure that WE meets its asset management objectives now and into the future. In the spirit of continual process improvement and integration of asset management policies and programs, WE has assembled an inter-divisional Asset Management Steering Committee (AMSC). The purpose of the AMSC is to ensure the integration and alignment of asset management programs, policies, and procedures, to the extent feasible, within WE. To assist in fulfilling its purpose, the AMSC may develop a specific Task Force to address the objectives listed in Section 2.1.1. Each Task Force will comprise subject matter experts and stakeholders from each division. Such a Task Force has been developed to address the asset framework effort currently underway.

Objective #2 – *Develop WE and Division-level matrices to clearly outline roles and responsibilities for asset management and O&M staff.*

> **Status and Update:** WE's progress toward this objective is at various stages. HHWP initiated an end-to-end review of current business processes related to asset management, including the review of current procedures for alignment with current "best practices." Complementing this work, asset management roles and responsibilities are being codified through the development of role and responsibility matrices for each business process, ensuring adequate staffing and training levels within the utility. WSTD initiated a year-long review of its asset work flow, from asset creation through asset life-cycle management. This resulted in the October 2020 finalization of the Asset Management Procedures. The Asset Management Procedures define asset management roles and responsibilities within WSTD, and the procedures for managing and maintaining assets in WSTD's Maximo database. NRLMD did not make progress on this objective during this reporting cycle. NRLMD will be reviewing HHWP's updated business processes when they are complete and will likely develop similar business processes for their assets.

3.3 Asset Management Objectives

Objective #1 – *Establish Asset Management Objectives for WE that map back to SFPUC's Asset Management Policy.*

> **Status and Update:** Each division participated in the development of the Asset Management Objectives for WE. The Asset Management Objectives are now established.

Objective #2 –*Review the objectives to meet the system's operational needs at least once every 2 years.*

Status and Update: Each division reviewed the Asset Management Objectives; no updates are recommended this reporting cycle because they were just established in 2022.

Objective #3 – *Report on the status of the Asset Management Objectives once every 2 years.*

Status and Update: Objective achieved. WE provided updates to all Asset Management Objectives.

3.4 Asset Registry

Objective #1 – *Continue to develop and maintain a detailed asset registry with increased standardization and uniformity across WE (asset classification, subclassification, specifications, and taxonomy).*

Status and Update: Divisions within the WE maintain asset registries of varying levels of development. HHWP and WSTD asset registries are reasonably well defined, detailed, and are used at all levels to inform O&M decisions, as well as project work. Both divisions maintain asset registries comprising tens of thousands of asset records and related attributes, as well as asset classification, subclassifications, and failure modes. NRLM has identified the need for an asset registry centrally located in CMMS; it is consistently and systematically moving to meet this requirement, with resource plans in place to achieve that end. Regardless of current maturity level, there is an effort throughout WE to move together toward a common framework for its asset management practices (facilitated by a contractor). The effort is focused on the foundational levels of EAM, following the Asset Management Pyramid depicted in Figure 3-1. Two building blocks of EAM were examined in detail by the consultant for implementation of the framework:

- asset classifications and attributes; and
- asset/functional location hierarchy.

In an effort to move toward greater uniformity and standardization of asset registries WE spent the last year agreeing on a common framework for asset registries, attributes, taxonomy, functional/location hierarchies, asset classifications, and failure classifications. Significant progress was made in this effort. However, it is worth noting that much remains; reorganizing tens of thousands of existing assets owned by WE divisions and populating key asset attributes to the asset specification tab will be a multi-year effort. As WE divisions work on advancing the maturity of each of its asset management programs, the principles of the Asset Management Pyramid will be followed to the extent possible, and each division may mature at a different pace.

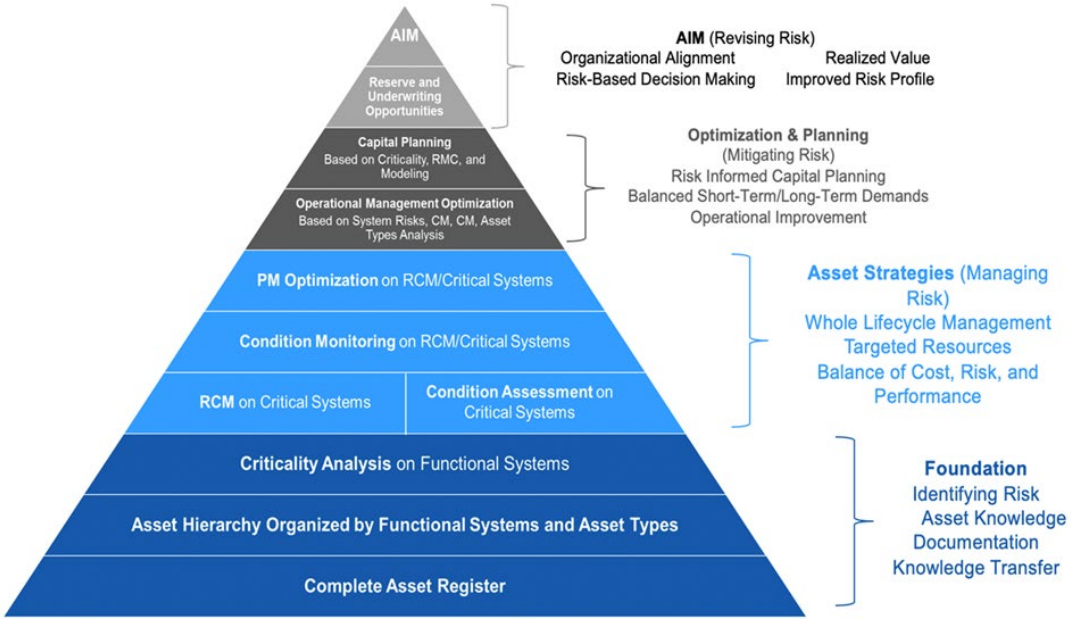


Figure 3-1: Asset Management Pyramid

Objective #2 – *Develop a shared definition of an "asset" throughout WE.*

> **Status and Update:** CCSF's Controller's Office Policy and Procedures Manual has a detailed definition of "fixed" assets. Generally, items that are "used in operations," "have a useful life over one year," and have an initial value greater than $5,000 are considered assets by city definition and are treated as such. WE's definition for what constitutes an asset for inclusion in Maximo is included in its October 2020 Asset Management Procedures; a standardized definition beyond this, for use throughout WE, has yet to be developed.

Objective #3 – *Continue to use and standardize location and functional/location hierarchies within CMMS and GIS.*

> **Status and Update:** WE is in the process of standardizing multiple datasets in CMMS and GIS, including location and function. This is being accomplished both through the inter-divisional asset framework and asset registry update efforts, which include representatives from all WE divisions.
>
> WSTD's transmission and distribution pipeline, line valve, and vault assets are in both Maximo and GIS. WSTD is currently collecting and updating pipeline appurtenance data as part of the Regional Cross-Connection Controls Project (RCCCP). Similarly, HHWP has more than 16,000 assets in Maximo and is preparing to complete an audit of these assets to confirm consistency throughout the dataset.
>
> The AMSC will also influence how GIS is used as an asset management tool and will set standards for uniformity across WE. HHWP, WSTD, and NRLMD have all

advanced their GIS databases over the reporting cycle, securing multiple professional services task orders that will continue to support WE into next reporting cycle.

Objective #4 – *Develop and maintain a GIS database for WE's linear assets.*

Status and Update: WE made significant investments into advancing the GIS databases. The GIS database was advanced to include enterprise web maps and dashboards for viewing pipeline asset data; the ability to search using mile marker, SFPUC placename, pipeline station, and/or appurtenances; and the ability to spatially link from the web map to SharePoint to access pipeline drawings and documents for SJPLs, power transmission lines, and underground utilities. In the Bay Area, the GIS database provides support for critical programs such as pipeline inspection, Underground Service Alert, emergency response, and hydraulic modeling. It has become a component in succession planning because of its ability to share linear asset data intuitively with new employees. There are also numerous GIS-based displays that can be used to view work orders in the office or on mobile devices in the field.

3.5 Asset Condition

Objective #1 – *Complete planned and scheduled asset condition assessments that inform maintenance, investment, and risk mitigation strategies.*

Status and Update: WE completed multiple condition assessments during this reporting cycle. WE recognizes the value of this objective and intends to continue making progress during the next reporting cycle.

Objective #2 – *Prioritize condition assessments to increase system reliability.*

Status and Update: WE recognizes the value of this objective and intends to make progress during the next reporting cycle. WE currently does not have a written prioritization strategy for performing condition assessments. WE intends to review individual condition assessment program-level documents, such as WSTD's approach for performing inspection and condition assessments of its linear assets, to assist in the development of a condition assessment prioritization strategy that is consistent across WE and applicable to both linear and fixed assets.

3.6 Operations and Maintenance Strategies

Objective #1 – *Develop an SAMP and individual AMPs.*

Status and Update: During this reporting cycle, WE made progress on this objective by completing multiple AMPs on the HHWP system, with additional AMPs in progress and on track for completion during the next reporting cycle. WE recognizes the importance of the SAMP, and has identified resources and drafted a draft scope of work for its completion in the next reporting cycle.

Objective #2 – *Establish the ability to use CMMS to demonstrate compliance with federal, state, and local regulatory requirements.*

> **Status and Update:** WE is making progress on this objective, focusing on both HHWP and WSTD. HHWP and WSTD have a maturing capability to use Maximo data to provide evidence of compliance for multiple regulators, and have incorporated regulatory-driven preventive maintenance (PM) requirements in their Maximo databases. The PM completion records are regularly used by HHWP and WSTD facility managers to demonstrate compliance with federal, state, and local regulatory requirements during inspections and audits.

Objective #3 –*Demonstrate proper stewardship of environmental resources under SFPUC control through the use of CMMS reporting.*

> **Status and Update:** WE's environmental review requirements are fully integrated using Maximo for WSTD and HHWP. This is accomplished through the review of Maximo service requests, PM plans, work orders, and crew schedules. The key stake holders who provide input to this process include environmental planners, maintenance planners, supervisors, and managers, as well as frequent input from state and federal partners—all working together to ensure the best use and stewardship of WE's environmental resources. Over the next reporting cycle, NRLMD is evaluating strategies to build into Maximo an environmental review of assets that are currently captured in their GIS database.

3.7 Asset Investment Strategies

Objective #1 – *Use asset management data to develop expenditure reports that compile costs for facilities, assets, and maintenance programs.*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

Objective #2 – *Develop and implement a replacement planning approach to estimate asset useful life, renewal, and replacement requirements and costs.*

> **Status and Update:** WE made varying amounts of progress on this objective. HHWP's approximately 15,000 assets were summarized into approximately 1,200 assemblies. For each of these assemblies, HHWP calculated a percentage of useful life (age divided by expected life). Additionally, a high-level cost estimate for replacement was completed for each assembly. WSTD and NRLMD did not make progress on this objective during this reporting cycle. There are currently no cost data or estimates of asset useful life for WSTD's assets in Maximo. WSTD is working toward obtaining asset cost data and useful life estimates for new capital assets.

Objective #3 – *Design future facilities based on information gathered through the asset management program.*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

3.8 Budgeting

Objective #1 – *Update the 10-Year CIP and annual operating budget by integrating data from condition assessments, estimates of remaining useful life, failure analyses, replacement costs, maintenance programs, and LOS into a well-informed forecast of Capital and R&R Program costs.*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

Objective #2 –*Develop expenditure reports that compile costs for facilities, assets, and maintenance programs – a quick way to tell where money is going and what it is accomplishing.*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

3.9 Performance Monitoring

Objective #1 –*Formalize asset failures analysis and root cause analysis across WE.*

> **Status and Update:** WE made varying amounts of progress on this objective. WSTD performs root cause analysis for failures that impact RWS performance or regulatory compliance. These incident reports are completed by operational staff. HHWP and NRLMD did not make progress on this objective.

Objective #2 – *Complete peer reviews of maintenance programs to ensure that the scope of maintenance is consistent with industry standards and create opportunities to increase standardization and uniformity across the WEEAM Programs*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

Objective #3 – *Establish and maintain Key Performance Indicators to track planning and scheduling, asset, and asset management efficiency and effectiveness.*

> **Status and Update:** WE did not make progress on this objective during this reporting cycle.

3.10 Levels of Service

Objective #1 –*Review LOS goals and objectives every odd year.*

> **Status and Update:** WE reviewed the LOS during the reporting cycle.

4. Asset Description, Maintenance and Condition, and Capital Improvements

This section is organized by the primary asset types that make up RWS:

Water Storage	*Water Treatment*	*Water Transmission*
Water Distribution	*Buildings and Grounds*	*Power Generation*
Power Transmission	*Power Distribution*	*Watersheds, Roads, and Bridges*
Wastewater Treatment	*Communications and Control*	

For each asset type, SFPUC is providing (1) a description of the assets; (2) a summary of the maintenance completed and condition; and (3) information on the asset's active or planned capital investments.

WE is actively working to review and update its PM records. The effort is anticipated to take 5 years, with 2022 being year 1. As this effort progresses, so will the information provided in the SRWS report.

For the capital improvement projects, details on the most current scope, schedule, and budget are provided quarterly and published through SFPUC meeting agendas and meeting minutes. For the purposes of the SRWS report, the capital improvement sections include (1) a summary of the scope of work; (2) an explanation of how the capital investment aligns with WE's LOS; and (3) a summary of the project milestones that were achieved during the current reporting cycle.

4.1 Water Storage Assets

SFPUC owns and operates multiple dams to store water both upcountry and locally in the greater Bay Area region. For asset classification purposes, outlet piping, valves, and spillways are considered part of the dams. The dams are regulated by the State of California's Division of Safety of Dams (DSOD).

4.1.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of six dams**.** The dams include medium head dams that are used as regulating reservoirs, as well as larger high head dams that provide water storage for RWS.

4.1.1.1 Asset Descriptions, Maintenance, and Condition

O'Shaughnessy Dam

Description. RWS begins in the Hetch Hetchy Valley of Yosemite National Park at O'Shaughnessy Dam and Hetch Hetchy Reservoir. O'Shaughnessy Dam is a 312-foot-high above-streambed (430 feet above the lowest point in the foundation) gravity arch dam that impounds 360,360 acre-feet (AF) of water along the main stem of the Tuolumne River, creating Hetch Hetchy Reservoir. The dam was originally built in 1923 and raised in 1938. Hetch Hetchy Reservoir collects water from the surrounding 459 square miles of the Hetch Hetchy watershed for the purpose of

providing potable water supply to the Bay Area and power generation at Kirkwood and Moccasin Powerhouses.

Maintenance. Table 4-1 summarizes maintenance work.

Table 4-1: O'Shaughnessy Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed annually	Annual exercise of Valves 1 through 8, 12, 13, 15, and 16 (Note: Valves 1 and 2 were not exercised in 2021 due to low lake levels)
Vegetation Management	As needed	Removal of vegetation on dam, along groins and near leakage weirs
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels and releases via SCADA alarms
	Completed weekly	Weir leakage
	Completed annually	Joints, settling and deflection surveys

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. The dam's concrete is in good condition; however, much of its mechanical equipment has exceeded its anticipated useful life and requires capital improvement. This includes the face valves, instream flow release (IFR) valves, slide gates, and bulkheads. Currently, one of the two IFR valves does not operate; however, normal dam operations can be performed with only one valve in operation. The bulkheads (aka shutter gates) are also nonoperational, which impacts HHWP's ability to perform maintenance on the supply wells and slide gates. Additionally, much of the dam's access structures and drainage systems are inadequate and require capital investment. O'Shaughnessy Dam is fit for service; however, its mechanical equipment requires capital investment to ensure reliable future operations.

Cherry Valley Dam

Description. Cherry Valley Dam is a 330-foot-high earth and rock fill dam. Lake Lloyd, the reservoir impounded by Cherry Valley Dam, stores approximately 273,500 AF. The dam was built in 1955. Water from the Cherry-Eleanor system is used for downstream flow obligations and power generation at Holm Powerhouse. With treatment and prior DDW approval, water from Lake Lloyd can be used to provide additional water supply in drought or emergency conditions.

Maintenance. Table 4-2 summarizes maintenance work.

Table 4-2: Cherry Valley Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed monthly	Exercise Butterfly Valves 1 and 2 and Jet Flow Valves 1 and 2
	Completed annually	Exercise of Butterfly Valve 3
Vegetation Management	As needed	Removal of vegetation on dam, along groins and near leakage weirs
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels and releases via SCADA alarms
	Completed weekly	Weir leakage
	Completed annually	Settling and deflection surveys

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Cherry Valley Dam is in satisfactory condition; however, the intake tower to Cherry Power Tunnel requires rehabilitation. Additionally, the spillway is unable to pass the facility's design flood. As a result of the spillway condition, HHWP has implemented a Forecast Informed Reservoir Operations (FIRO) strategy to avoid spill. Cherry Valley Dam is fit for service; however, the facility requires capital investment to address the items noted.

Lake Eleanor Dam

Description. Eleanor Dam is a 70-foot-high concrete buttressed arch dam. Lake Eleanor stores approximately 27,113 AF (capacity with flashboards). The dam was built in 1918. Water from the Cherry-Eleanor system is used for downstream flow obligations and power generation at Holm Powerhouse. With treatment and prior DDW approval, water from the Lake Eleanor can be used to provide additional water supply in drought or emergency conditions.

Maintenance. Table 4-3 summarizes maintenance work.

Table 4-3: Lake Eleanor Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed annually	Annual exercise of Slide Gates 1 through 4 and guard valves 3A and 4A
Vegetation Management	As needed	Removal of vegetation on dam and along groins
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels and releases via SCADA alarms
	Completed annually	Settling and deflection surveys

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Lake Eleanor Dam is in satisfactory condition and is fit for service; however, the facility requires capital investment to address the condition of the bridge, as well as concrete and erosion protection.

Early Intake Dam

Description. Early Intake Dam is an 81-foot-high concrete arch dam that impounds a storage volume of about 115 AF. The dam was built in 1924. Located on the mainstem of the Tuolumne River just downstream of Kirkwood Powerhouse, the dam provides the flexibility to divert water from the Tuolumne River or diversions from Lower Cherry Aqueduct (LCA) into Mountain Tunnel. With treatment and prior DDW approval, water diverted at this dam into RWS can be used to provide additional water supply in drought or emergency conditions.

Maintenance. Table 4-4 summarizes maintenance work.

Table 4-4: Early Intake Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed annually	Annual exercise of Sluice Gates 1 and 2, and Guard Gates 1 and 2
Vegetation Management	As needed	Removal of vegetation on dam and along groins
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels and releases via SCADA alarms
	Completed biannually	Cracks, settling, and deflection surveys
	Completed annually	Lidar surveying of dam movement and crack mapping

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Early Intake Dam is in poor condition. The dam's concrete has a well-documented history of alkali aggregate reaction, which has resulted in cracking and joint failures at the lift lines. Additionally, during the planning phase of the "Interim Improvements Project," a potential stability issue was discovered, which has resulted in abandoning the interim repair project to accelerate the long-term improvements project. The dam is still capable of diverting water from LCA into Mountain Tunnel if an alternative water source for consumption by RWS customers is needed; however, it is nearing the end of its useful life, and capital investment is required.

Priest Dam

Description. Priest Dam is a 160-foot-high earth and rock dam that impounds a storage volume of 1,706 AF. The dam was built in 1923. Priest Reservoir stores Hetch Hetchy water before it reaches Moccasin Powerhouse via Moccasin Power Tunnel. Priest Reservoir has a pipeline bypass that

can be used when local reservoir turbidities are high, typically during and following storm events.

Maintenance. Table 4-5 summarizes maintenance work.

Table 4-5: Priest Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed annually	Annual exercise of Bypass Butterfly Valve, Slide Gates 1 and 2, and Drain Valve
Vegetation Management	As needed	Removal of vegetation on dam, along groins and near leakage weirs
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels, inflows, and releases via SCADA alarms.
	Completed weekly	Leakage weirs
	Completed monthly	Piezometers
	Completed biannually	Settling and deflection surveys

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Priest Dam is in satisfactory condition and is fit for service. The dam has a history of settlement and deflection, most of which occurred early in the dam's life cycle. HHWP intends to evaluate whether additional instrumentation is warranted for the dam and will also perform an updated stability analysis and geotechnical exploration.

Moccasin Dam

Description. Moccasin Dam is a 70-foot-high earth and rock dam that impounds a storage volume of 552 AF. The dam was built in 1929. After leaving Moccasin Powerhouse, RWS water is stored at Moccasin Reservoir to provide a constant flow rate in the Foothill Tunnel. Moccasin Reservoir has a bypass pipeline that can be used when local reservoir turbidities are high or when performing maintenance at Moccasin Reservoir.

Maintenance. Table 4-6 summarizes maintenance work.

Table 4-6: Moccasin Dam Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	Completed Annually	Annual exercise of Gates 1, 1A, 2, 2A, and 3
Vegetation Management	As needed	Removal of vegetation on dam, along groins and in spillway
Inspection	Completed weekly	Inspected by watershed keepers
	Completed annually	Inspected by safety engineer
Surveillance and Monitoring	Continuously monitored	Reservoir water levels, inflows, and releases via SCADA alarms.
	Completed weekly	Leakage weirs
	Completed monthly	Piezometers
	Completed biannually	Settling and deflection surveys

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Moccasin Dam is in satisfactory condition; however, the spillway is undersized and is not capable of passing the updated design flood that resulted from the March 2018 storm. The dam is fit for service; however, capital investment is required to increase the spillway capacity of the facility.

4.1.1.2 Capital Improvements

HHWP currently has nine active capital projects on its water storage assets, representing a total capital investment of $378.7 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the active large capital projects are provided in the following sections.

O'Shaughnessy Dam Outlet Works Phase I (Approved Budget: $47.9 Million; Substantial Completion: 2025)

Scope. The project includes four subphases: (1) replacement of two IFR valves; (2) improvement to access and drainage in the gallery and stairs; (3) installation of new bulkheads; and (4) the planning phase for the slide gate and drum gate rehabilitation.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-7.

Table 4-7: O'Shaughnessy Dam Outlet Works Phase I Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Bulkheads. Draft Conceptual Engineering Report (Revised)	June 2021
Bulkheads. Conceptual Engineering Report (Final)	August 2021
Bulkheads. Underwater Inspection and Trial Cleaning	January 2022
Instream Flow Release. Needs Assessment/Alternatives Analysis Report	June 2022
Drum Gates. Updated Stress Analysis Report	December 2021

O'Shaughnessy Dam Outlet Works Phase II (Approved Budget $112.2 Million; Substantial Completion 2031)

Scope. The scope of Phase II includes (1) replacement of six 60-inch and one 72-inch needle valve; (2) refurbishment of one 72-inch butterfly valve; (3) rehabilitation of three drum gates; (4) refurbishment or replacement of 12 slide gates (beginning with design phase); (5) installation of a new 108-inch diversion pipe isolation valve; and (6) improvements to the division tunnel.

Milestones Completed During the Reporting Cycle. The project is scheduled and budgeted to begin in 2024; therefore, no milestones were achieved during this reporting cycle.

O'Shaughnessy Dam Access and Drainage (Approved Budget $4.0 Million; Substantial Completion 2022)

Scope. The scope of this project was reduced to only access improvements, including fall protection systems that meet Occupational Safety and Health Administration requirements for multiple ladders and landings.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-8.

Table 4-8: O'Shaughnessy Dam Access and Drainage Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
HH-1002 – Completed 100% design	July 2020
HH-1002 – Rejected the single bid	November 2020
HH-1002R – Repackaged and readvertised	March 2021
HH-1002R – Issued construction notice to proceed	September 2021
HH-1002R – Substantial completion	June 2022

Cherry Dam Spillway – Short-Term Improvements (Approved Budget $11.9 Million; Substantial Completion: 2027)

Scope. The scope of this project is not confirmed and requires additional planning. The objective of the project is to design and construct improvements to the unlined channel that will minimize erosion damage to the chute and eliminate the potential hazard to the dam when releases are made through the spillway.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-9.

Table 4-9: Cherry Dam Spillway – Short-Term Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Planning and Design – Issued a notice to proceed for professional services under PRO.0138B	March 2021

Moccasin Dam and Reservoir Long-Term Improvements (Approved Budget $73.2 Million; Substantial Completion 2028)

Scope. The project will involve making the improvements required to safely pass the updated design flood; this will include a new concrete spillway.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-10.

Table 4-10: Moccasin Dam and Reservoir Long-Term Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Planning and Design Services – notice to proceed for Professional Services under PRO.0138A	May 2021
AAR	December 20221

Note:
AAR = Alternatives Analysis Report

Early Intake Dam Interim Improvements (Approved Budget $2.8 M; Substantial Completion: Not Applicable)

Scope. The objective of the Interim Improvements Project was to extend the life of Early Intake Dam by 20 to 25 years so that the long-term improvements project could be deferred. The scope of the project was budgeted for relatively minor improvements, such as grouting or an upstream liner. Unfortunately, a new stability concern was discovered during the investigation phase of the project that could not easily be remedied by interim measures. In light of the new information, the Interim Improvements Project was closed, and the resources were reallocated to accelerate the "Long-Term" project.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-11.

Table 4-11: Early Intake Dam Interim Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR (interim repairs)*	December 2020

Notes:

* The interim repairs project did not advance; resources were reallocated to the long-term improvements project.

AAR = Alternatives Analysis Report

Early Intake Dam – Long-Term (Approved Budget $94.7 Million; Substantial Completion: 2028)

Scope. The scope of this project is not confirmed and requires additional planning. The objective of the Long-Term Project is to provide a long-term solution for the dam, which has been experiencing significant cracking and deterioration from alkali-aggregate reactivity since construction in the 1920s.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-12.

Table 4-12: Early Intake Dam – Long-Term Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Planning and Design Services – Notice to proceed for Professional Services under PRO.0138B	April 2021

Eleanor Dam Rehabilitation (Approved Budget $28.6 Million; Substantial Completion: 2030)

Scope. The scope of this project is not confirmed and requires additional planning. Mitigation alternatives may include solutions such as improvements to increase the spill capacity, installation of a liner on the upstream face of the dam, pressure grouting, concrete repairs, valve replacement, and installation of concrete lining and riprap.

Milestones Completed During the Reporting Cycle. The project is scheduled and budgeted to begin in 2023; therefore, no milestones were achieved during this reporting cycle.

Moccasin Reservoir Perimeter Security Fence (Approved Budget $3.4 Million; Substantial Completion: 2021)

Scope. The scope of this project included installation of an approximately 5,000-foot-long perimeter security fence system around Moccasin Reservoir to discourage trespassers. Construction for this project was completed during the reporting cycle.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-13.

Table 4-13: Moccasin Reservoir Perimeter Security Fence Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Completed Construction	March 2021

Summary of Levels of Service Impacts

LOSs that are supported by the HHWP water storage capital improvements are provided in Table 4-14.

Table 4-14: HHWP Water Storage Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
O'Shaughnessy Dam Outlet Works Phase I	✓					✓	✓	✓
O'Shaughnessy Dam Outlet Works Phase II			✓			✓		
O'Shaughnessy Dam Access and Drainage								✓
Cherry Dam Spillway – Short-Term Improvements			✓			✓	✓	✓
Moccasin Dam and Reservoir Long-Term Improvements	✓		✓			✓	✓	
Early Intake Dam Interim Improvements			✓					
Early Intake Dam – Long Term			✓					
Eleanor Dam Rehabilitation			✓			✓	✓	✓
Moccasin Reservoir Perimeter Security Fence	✓		✓			✓		

Notes:
HHWP = Hetch Hetchy Water and Power

4.1.2 Regional Water

WSTD is responsible for the maintenance and operation of five dams. The dams, situated in the East and West Bay, are part of a system of local reservoirs that provide water storage for RWS.

4.1.2.1 Asset Descriptions, Maintenance, and Condition

Calaveras Dam

Description. Calaveras Dam is a 220-foot-high earth and rockfill dam. The original dam was completed in 1925, and a new replacement dam was completed in 2019. Calaveras Reservoir is SFPUC's largest local reservoir. It has a capacity of 96,850 AF and is capable of holding 42 percent of the local storage capacity and 7 percent of the total system capacity. It is filled by direct inflow from Arroyo Hondo and Calaveras Creek, as well as from Alameda Creek via the Alameda Creek Diversion Dam facility. The spillway is an open channel with an ogee crest capable of passing the probable maximum flood (PMF). The outlet works is equipped with three levels of adit valves that provide operational flexibility. A lower fourth adit allows the reservoir to be emptied in an emergency.

Maintenance. Table 4-15 summarizes maintenance work.

Table 4-15: Calaveras Dam Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	January 12, 2021 November 3, 2021* April 21, 2022	12-month valve exercise for V21, V22, V23, V25, V26, V27, V31, V33, and V34
Vegetation Management	November 8, 2021 June through October 2021 April through June 2022	Goat grazing Rodent Control
Monthly Inspection	Completed monthly	Frequency of inspection: weekly during rainy season and monthly during nonrainy season, in accordance with the initial fill plan and SOP
Surveillance and Monitoring	January 15, 2021	Engineering survey performed by AECOM

Notes:

* Completed in DSOD's presence.

PM = preventive maintenance
SOP = standard operating procedure

Condition. Calaveras dam is in satisfactory condition. The dam crest was well aligned, and no signs of instability or distress were noted. The upstream riprap was uniform and intact. No cracking was noted on the crest pavement. At the spillway, the concrete surface appeared to be in satisfactory condition. Minor spalling and cracking on the concrete spillway were observed. Some of the sealant area and joint area started to deteriorate. Repair of the concrete defects are in the planning phase. The outlet structure, including the adit valves and controls, was in good condition. No significant concrete cracking, spalling, or signs of structural distress were observed. Minor seepage and mineral deposits were observed inside the intake structure. Vegetation and rodent control were deemed acceptable. Overall, the dam, reservoir and all appurtenances are safe for continued use.

Turner Dam

Description. Turner Dam, which impounds water at the San Antonio Reservoir, is a 195-foot-high earth embankment dam. San Antonio Reservoir is one of two SFPUC reservoirs in the East Bay. It is the third largest local reservoir, with a capacity of 50,500 AF. The dam, completed in 1965, was constructed on San Antonio Creek, a tributary of Alameda Creek. The reservoir is used to capture and store local runoff. It is also used to store water transferred from Hetch Hetchy Reservoir, Calaveras Reservoir, the South Bay Aqueduct blow-off, and Pond F3 East.

Maintenance. Table 4-16 summarizes maintenance work.

Table 4-16: Turner Dam Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	January 6, 2021;* March 14, 2022	12-month valve exercise for Y01, Y02, Y03, Y04, Y05, Y20, Y21, and Y22 was performed in DSOD's presence
Vegetation Management	October 19, 2021 June through October 2021 April through June 2022	Goat grazing Rodent control
Monthly Inspection	Completed monthly	
Surveillance and Monitoring	December 8, 2020 August 5, 2021 December 1, 2021	Semi-annual surveillance and monitoring

Note:

* Y22 was not cycled due to environmental restrictions.

DSOD = Division of Safety of Dams
PM = preventive maintenance

Condition. Turner Dam is in satisfactory condition. The dam crest was well aligned, and the embankment showed no signs of instability or distress. Vegetation control was acceptable, except in the discharge channel. The heavy vegetation inside the discharge channel could hinder full capacity use in the event of an emergency release. At the spillway, the concrete showed no significant structural deficiencies. Spillway wall cracks were repaired in 2021. The riprap of the downstream channel appeared to be stable and intact. Rodent control was satisfactory, with no significant burrowing activity observed. There was heavy erosion observed on the only access road to the inlet gallery. The erosion repair work is currently in the planning phase. With the exception of Y01, all the upstream valves are operable. Valve Y01 is clogged with silt. Valve Y02 had an electrical issue, which has since been repaired. Overall, the dam, reservoir, and all appurtenances are safe for continued use.

Pilarcitos Dam

Description. Pilarcitos Dam is a 95-foot-high earthen embankment dam. It was constructed in 1866, raised in 1874, and is the oldest DSOD jurisdictional dam in RWS. The reservoir storage capacity is 3,100 AF. Pilarcitos Reservoir supply can be transferred to LCSR for storage; transferred to the Coastside County Water District, which serves the Half Moon Bay area; and/or be environmentally released.

Maintenance. Table 4-17 summarizes maintenance work.

Table 4-17: Pilarcitos Dam Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	January 25, 2022	Valves S10, S11, and S12 exercised in DSOD's presence
Vegetation Management	October 15, 2020 June 9, 2021* September 27, 2021 November 2021 to June 2022	Prescribed burn and vegetation clearings were conducted at Pilarcitos Dam Rodent control
Monthly Inspection	Completed monthly	
Surveillance and Monitoring	November 30, 2020 July 26, 2021 November 22, 2021 May 25, 2022	Semi-annual surveillance and monitoring

Notes:

* Control burn.

DSOD = Division of Safety of Dams
PM = preventive maintenance

Condition. Pilarcitos Dam is currently in satisfactory condition, with DSOD signaling a forthcoming change to a rating of "fair." The dam and the embankment showed no immediate signs of instability or distress. The riprap on the stream face appeared to be stable and uniform. Vegetation and rodent control were acceptable. Clusters of burrow holes were observed at the downstream face of the dam, and sensitive habitat flags were observed on the left groin. Due to environmental concerns, SFPUC cannot implement a more robust rodent and vegetation control plan. At the spillway, the concrete repair held up well. No new cracks or spalls were noted. One of the slide gates is not operational, due to corrosion at the U-shaped spillway weir. This work will be included in the next CIP project. The valves in the outlet structure are fully operational. The dam, reservoir, and all the appurtenances are safe for continued use.

Stone Dam, downstream of Pilarcitos Reservoir, is a nonjurisdictional thin arch masonry dam constructed in 1871 by the Spring Valley Water Company. It currently serves as a diversion structure to supply water to Coastside County Water District. Regular maintenance of the spillway is required for this purpose. The dam survived the 1906 and 1989 earthquakes, and impoundment is minimal enough that it does not qualify as a DSOD jurisdictional dam.

Stone Dam is in satisfactory condition, but structural deterioration of the spillway access structure prevents operational use of its stop logs; and the reservoir storage capacity is limited due to sediment deposition and lack of regular dredging.

Upper and Lower Crystal Springs Dams

Description. Upper Crystal Springs Dam (UCSD) is a 92.5-foot-high non-DSOD jurisdictional earth embankment dam. It was built in 1877, and was raised in 1891 and again in 1924. In 1924, modifications were made to the UCSD so that unregulated flow is provided between UCSR and LCSR, functionally making them act as one. UCSD is also the roadbed supporting Highway 92 as

it crosses the reservoirs. UCSR stores local runoff and water from Hetch Hetchy. Water from Hetch Hetchy is dechloraminated or dechlorinated and adjusted for pH at the Pulgas Dechloramination Facility before entering UCSR.

LCSD is a 163-foot-high concrete gravity dam constructed in 1890. The dam was built with interlocking concrete blocks and survived both the 1906 and 1989 earthquakes without significant damage. The combined storage capacity of UCSR and LCSR is 69,300 AF. In 2015, SFPUC completed a WSIP project that enlarged the spillway and stilling basin, raised the parapet wall, and improved the emergency outlet works. These improvements enable the PMF and other very large and infrequent floods to safely pass LCSR spillway, outlet works, and dam crest, as well as restoring LCSR to its historical storage capacity.

Maintenance. Table 4-18 summarizes maintenance work.

Table 4-18: Lower Crystal Springs Dam Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	December 9 2020 December 14, 2021*	12-month valve exercise for H81, H82, H84, H87, H91, H92, H10, H11, H12, H20, H21, and H22
Vegetation Management	None performed	Vegetation removal will be done in the summer of 2022 by a JOC contractor under the Access Stairs Installation Project
Monthly Inspection	Completed monthly	
Surveillance and Monitoring	November 5, 2020 July 29, 2021 November 7, 2021 June 23, 2022	Semi-annual surveillance and monitoring

Note:

* Completed in DSOD's presence.

JOC = job order contract
PM = preventive maintenance

Condition. Lower Crystal Dam is in satisfactory condition. The interlocking concrete blocks showed no new signs of structural distress. The spillway approach, control section, stilling basin, and downstream channel were clear and unobstructed. The concrete surface of the spillway and walls have minor cracking, consistent with curing. The outlet was fully operational. However, the vegetation control at the groin area needs improvement.

San Andreas Dam

Description. San Andreas Dam is a 105-foot-high earth embankment dam, built in 1870, with a storage capacity of 19,000 AF. The San Andreas Fault runs along the eastern abutment of the dam. This reservoir is adjacent to the HTWTP and is the raw water source for the plant. The reservoir stores local runoff and water pumped from LCSR through CSSAPL from the CSPS. Two outlet structures, San Andreas Outlet Structure 2 and San Andreas Outlet Structure 3, were upgraded by WSIP in 2015.

Maintenance. Table 4-19 summarizes maintenance work.

Table 4-19: San Andreas Dam Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Exercise	September 29, 2021	12-month valve exercise for N21, N31, and N33 in DSOD's presence
Vegetation Management	February 6, 2021 June 9, 2021* June 7, 2022 November 2021 through June 2022	Prescribed burn was conducted on San Andreas Dam. Rodent Control
Monthly Inspection	Completed monthly	
Surveillance and Monitoring	November 24, 2020, July 18, 2021, November 18, 2021, June 7, 2022	Semi-annual surveillance and monitoring

Notes:

* Control burn.

DSOD = Division of Safety of Dams
PM = preventive maintenance

Condition. San Andreas Dam is in only fair condition due to the condition of its spillway. The paved crest, upstream and downstream slope, and abutment contacts showed no signs of instability or distress. The upstream riprap was even and uniform. Vegetation and rodent control were generally good. Sensitive habitat flags and rodent borrows were observed on the downstream face of the dam. Due to environmental concerns, SFPUC cannot implement a more robust vegetation control or rodent control plans. At the spillway, the concrete surface was in fair condition. Typical concrete cracks on the spillway wall and flood are hairline cracks and concrete spalls. Periodic repair of the concrete is required because the spillway is in the vicinity of San Andreas Fault and is subject to ground creep. The spillway approach, control structure, and downstream chute were clear and unobstructed. The steel beams under the spillway bridge are corroded. A plan to bring in a contractor to blast and repaint the beams is in progress. The spalling at the underside of the deck was repaired. No new cracks or spalls were noted. The valves in the two outlet structures were operational. This dam, reservoir, and all their appurtenances are safe for continued use.

4.1.2.2 Capital Improvements

Regional Water currently has 15 active capital projects in its water storage program, representing a total capital investment of $290 million. Summaries for the large capital projects are provided in the following sections.

Calaveras Reservoir Expansion Project (Approved Budget: $7.5 Million; Substantial Completion: 2033)

Scope. This storage project involves the potential expansion of Calaveras Reservoir to store excess regional water supplies or other source water in wet/normal years. Current storage capacity is 96,850 AF (or 31 billion gallons) of water. The expansion could increase storage by as much as 289,000 AF (or 94 billion gallons), for a new storage capacity of up to 385,850 AF (or 125 billion

gallons) of water. Depending on the findings from the alternatives analysis, the proposed project would include (1) raising the dam; (2) increasing the capacity of the outlet structures and the spillway; and (3) adding any transmission and pumping needed to bring water to Calaveras Reservoir.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-20.

Table 4-20: Calaveras Reservoir Expansion Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Final Dam Raise Feasibility Study	December 28, 2020
Conveyance System Feasibility Study	April 4, 2022

Turner Dam and Reservoir Improvements Project (Approved Budget: $7.5 Million; Substantial Completion: 2033)

Scope. The project will involve investigation of the seismic stability and hydraulic performance of the Turner Dam and San Antonio Reservoir facilities; the necessary upgrades (to be determined during the Planning Phase) will be performed, including those to the embankment dam, outlet tunnel and pipeline, concrete spillway, and other ancillary facilities.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-21.

Table 4-21: Turner Dam and Reservoir Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Spillway Condition Assessment – Phase 2	November 30, 2021
Probable Maximum Flood Study	April 2022

Pilarcitos Dam Improvements Project (Approved Budget: $30.09 Million; Substantial Completion: 2027)

Scope. The project will involve investigating the seismic stability and hydraulic performance of the Pilarcitos Dam and Reservoir facilities; the necessary upgrades (to be determined during the Planning Phase) will be performed, including those to the dam and forebay outlet structure, outlet tunnel, outlet pipeline, and spillway.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-22.

Table 4-22: Pilarcitos Dam Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Geotechnical Data Report	September 30, 2020
Dam Embankment Stability Analysis	June 30, 2021
Overall Project Condition and Needs Assessment	September 30, 2021

San Andreas Dam Facility Improvements Project (Approved Budget: $32.2 Million; Substantial Completion: 2032)

Scope. The project will involve investigating the seismic stability and hydraulic performance of the San Andreas Dam and Reservoir facilities; the necessary upgrades (to be determined during the Planning Phase) will be performed, including those to the embankment dam, emergency outlet and pipeline, spillways, and other ancillary facilities.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-23.

Table 4-23: San Andreas Dam Facility Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Overall Condition and Needs Assessment	December, 2021
Preliminary Embankment Stability Technical Memorandum	May 3, 2021

Summary of Levels of Service Impacts

LOSs that are supported by the RWS water storage capital improvements are provided in Table 4-24.

Table 4-24: RWS Water Storage Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Calaveras Reservoir Expansion Project						✓		
Turner Dam and Reservoir Improvements Project		✓				✓		
Pilarcitos Dam Improvements Project		✓	✓				✓	
San Andreas Dam Facility Improvements Project		✓						

Note:
RWS = Regional Water System

4.2 Water Treatment Assets

4.2.1 Hetch Hetchy Water

HHWP owns and operates one RWS treatment facility:

Rock River Treatment Facility

4.2.1.1 Asset Descriptions, Maintenance, and Condition

Rock River Treatment Facility

Description. Rock River Treatment Facility (aka Rock River Lime Plant) is situated along Foothill Tunnel near Jamestown, California. The plant doses Hetch Hetchy water deliveries to RWS with hydrated lime (calcium hydroxide) to raise the pH and alkalinity of the water for SJPL corrosion control. The plant includes two quicklime (calcium oxide) storage silos; lime dust handling equipment; two lime slakers, consisting of chemical feeders, rotary mixers, associated piping, and their controls; a backup electric generator and propane tank; and a bin for grit waste storage for offsite disposal.

Maintenance. Table 4-25 summarizes maintenance work.

Table 4-25: Rock River Treatment Facility Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Water Sampling	Completed weekly	Sampled for chemistry and bacterial agents
Instrument Verification and Calibration	Completed weekly	Instruments verified weekly
	Completed monthly	Instruments recalibrated monthly
Inspection	Completed weekly	Facility inspected by HHWP Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via internal dataloggers

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance

Condition. Rock River Treatment Facility is in good condition and remains fit for service.

4.2.1.2 Capital Improvements

There are no large capital improvements for HHWP's Water Treatment assets included in the current 10-year capital plan.

4.2.2 Regional Water

Regional Water has six major treatment facilities: TTF, Thomas Shaft Chlorination Facility, SVCF, SVWTP, Pulgas Dechloramination Facility, and HTWTP. TTF primarily treats Tuolumne-based

supplies, and the two filtration plants treat local watershed water. Treatment improvements are ongoing, such as the addition of ozone and flocculation aid polymer, to ensure reliable operation and meet the aesthetic expectations of customers. These facilities, along with small treatment facilities that are part of the supporting utilities at remote SFPUC locations, are listed in Appendix A.

Asset descriptions for the major RWS facilities are provided in the following sections, organized from upstream to downstream. Regional Groundwater Storage and Recovery Project (RGSR) wells are also included due to recent work done to construct the wells and upcoming work to improve the wells' operation.

4.2.2.1 Asset Descriptions, Maintenance, and Condition

Tesla Treatment Facility

Description. TTF is at the entrance to the CRT, near Tracy, California. Treatment of Hetch Hetchy supply at this facility consists of UV light and chlorine disinfection, pH reduction using carbon dioxide, and fluoride addition. The UV system was brought online during the summer of 2011 to meet regulatory requirements from the Long-Term 2 Enhanced Surface Water Treatment Rule. In the event of a chlorination failure at the TTF, the Thomas Shaft Chlorination Facility, about 4.4 miles west of Tesla on the CRT, will automatically start and boost chlorine to maintain disinfection. The detention time necessary for complete chlorine disinfection is obtained within the 25-mile length of the CRT.

Maintenance. Routine inspection and maintenance for the TTF is performed throughout the year. A comprehensive PM program is also completed for the facility when it is offline during any scheduled Hetch Hetchy outages. Additional maintenance service contracts for critical assets and components have been set up to provide quarterly inspection and diagnostics of the TTF electrical room heating, ventilation, and air conditioning (HVAC) air handling units; and quarterly and annual maintenance of the three flywheel UPS units. In early 2022, minor repairs were completed on two sodium hypochlorite storage tanks when small leaks were detected from the mating surfaces of the drain flanges.

Work continues with the modification of one of the existing carbon dioxide feed systems to enable the operator to feed chemical at a lower dose. Work is on hold due to manufacturer supply chain issues and will commence once the new flowmeter is received. Upon installation of the flowmeter, a functional test will be performed to confirm proper operation and control of the carbon dioxide system. Currently, the carbon dioxide feed system remains functional in manual mode.

The report for the previous reporting cycle discussed efforts to resolve the TTF UV lamp failures and lamp breaks. SFPUC staff worked closely with the original UV manufacturer, Calgon Carbon (now De Nora Water Technologies), to determine the root cause of the lamp breaks. The only lamp break during the current reporting cycle occurred on August 24, 2020, during routine UV sensor calibration. As of October 2020, all reactors have new lamps with a slightly reduced inert gas pressure and are operating using the original factory bank switching setpoints (i.e., higher power). The new lamps were provided to mitigate the phenomenon of acoustic resonance, which

Calgon considered to be the root cause of the breaks. The TTF has been operating successfully without any lamp breaks since August 2020.

Condition. TTF is in good condition. In 2023, PM and testing will be performed on the TTF electrical switchgear equipment. WSTD will also continue to explore options for more efficient treatment of the TTF domestic water system and installation of a booster pump to the existing water quality analyzers downstream of the TTF.

Thomas Shaft Chlorination Facility

Description. Thomas Shaft Chlorination Facility is 4.4 miles downstream of TTF on the CRT. Thomas Shaft serves two critical functions. First, it serves as a backup chlorination facility to provide disinfection of the water supply in the event of a failure of the chlorine feed system at TTF. Second, it serves as a potable water supply source for the Lawrence Livermore National Laboratory (LLNL) campus at Site 300. A small UV system at Thomas Shaft supplements disinfection for LLNL deliveries at high CRT flow rates. The initial standby disinfection facilities were installed in 1995 and subsequently upgraded in 2002. The disinfection facilities for the Lawrence Livermore supply were added in 2010/2011 as part of WSIP.

Maintenance. Recent improvements at the Thomas Shaft facility included the installation of a backflow preventer at LLNL's point of connection at Thomas Shaft; and replacement of the chemical feed piping between the storage tanks and metering pumps by in-house plumbers. In 2022, PM and testing were also performed on the electrical switchgear equipment.

Condition. Thomas Shaft Facility is in fair condition, due to a failed HVAC unit in the electrical room and failure of one of two sample pumps at the bottom of Thomas Shaft. An upcoming job order contract (JOC) will address these deficiencies. The JOC is expected to begin construction in the fall of 2022 and be completed by spring of 2023.

Sunol Valley Chloramination Facility

Description. SVCF is immediately adjacent to the Alameda Siphons. As part of WSIP, portions of the facility were modified from previous uses and other portions were newly constructed. The SVCF currently serves two primary functions: ammonia addition and sodium hypochlorite trim for chloramination, and caustic addition for corrosion control.

Additionally, the facility has the ability to feed sodium bisulfite for dechlorination and pH adjustment purposes. This operation is used during periods when (1) the Hetch Hetchy or SVWTP water do not meet drinking water standards and consequently must be discharged to either an adjacent quarry pit, San Antonio Creek, or San Antonio Reservoir; or (2) Hetch Hetchy water is used to refill San Antonio Reservoir and water must be treated to meet National Pollutant Discharge Elimination System (NPDES) requirements for total chlorine and pH prior to discharge.

SVCF also has a fluoride feed facility that was constructed to serve as a backup fluoride injection point for TTF and SVWTP. In addition, the adjacent Sunol Dechlorination Facility was later constructed to use calcium thiosulfate and fluoride for dechlorination and pH adjustment, respectively, of Hetch Hetchy water being transferred to the San Antonio Reservoir for storage.

Maintenance. Recent work includes the replacement of the uninterruptible power supply (UPS) system. This particular unit was at the end of its useful life. In early 2021, the 30-kilovolt-ampere

(kVa) UPS unit, external bypass switch, and input transformer were replaced to provide the facility with a reliable uninterrupted power supply between utility and backup generator power. In mid-2021, one of three fiberglass-reinforced plastic (FRP) sodium hypochlorite storage tanks at SVCF developed a small leak. The storage tank was drained, inspected, and subsequently repaired by an FRP tank repair vendor; it was returned to service by the end of 2021. In 2022, PM and testing were performed on the SVCF electrical switchgear equipment. In addition, ongoing efforts are being taken to replace older Coriolis-type flowmeters that are used to measure chemical dosing from the SVCF chemical metering pumps into the Alameda Siphons. The flowmeter replacements are being completed by WSTD's electronic maintenance technicians during scheduled shutdowns.

Condition. SVCF is in fair condition. The upcoming SVCF Improvements Project scope includes the replacement of the two 8,000-gallon aqua ammonia storage tanks and seismic upgrades of their concrete tank support pedestals; rehabilitation of the fluoride system; replacement of the carrier water pumps; system integration of the SVCF with the Sunol Dechlorination Facility; replacement of the SVCF chemical metering pumps and pump controllers; and upgrades to SVCF's main programmable logic controller (PLC) hardware. The project is expected to go out to bid in late 2022, with construction completion in 2024.

Sunol Valley Water Treatment Plant

Description. SVWTP was originally constructed in 1966 and expanded in 1974; significant improvements were completed in 2003 (Phase I) and in 2013 (WSIP). The SVWTP is a 160 mgd conventional filtration plant. Water from the Calaveras and San Antonio Reservoirs flows by gravity to the facility, where it goes through the treatment process. When higher flow rates are needed or not hydraulically feasible due to lower reservoir levels, the pumps at the San Antonio Pump Station (SAPS) are used to convey water from San Antonio Reservoir to SVWTP. Although an operational rarity, Hetch Hetchy water can be treated at the plant via SAPS to mitigate water quality issues. Water leaving the plant is chloraminated, fluoridated, and pH-adjusted before entering the Alameda Siphons via the facility's treated water reservoir. The plant is unique in that raw water passes through a distribution structure that channels the water to individual treatment trains. This allows the different raw water sources (Calaveras, San Antonio, and Hetch Hetchy) to be treated by different treatment trains. The WSIP project upgraded the existing filters and added a fifth flocculation and sedimentation basin, chlorine contactor, treated water reservoir, and chloramination and fluoridation systems. These upgrades greatly improved the plant's reliable capacity and redundancy. Improvements made since completion of the WSIP project include replacement of existing chemical piping, replacement of valves in the sludge lagoons, drainage improvements near an existing electrical building, installation of safety handrails around four existing sedimentation basins, relocation of the supervisory control and data acquisition (SCADA) server room, and installation of a powdered activated carbon (PAC) system to mitigate potential taste and odor (T&O) events.

Maintenance. Work currently underway at SVWTP includes the SVWTP and SVCF Aqua Ammonia Structural Repairs and Tank Replacement Project. Part of the scope of work is to make seismic modification and repairs to the SVWTP chemical unloading area canopy structure, and to the aqua ammonia and sodium hypochlorite canopy structure. Planning and design also continued on a new polymer feed facility to improve flocculation and sedimentation basin

performance. Other notable work performed included repairs to the plant UPS units, and concrete repairs to sedimentation basin No. 4.

Future projects nearing construction include the replacement of the generator diesel particulate filter and load bank, and replacement of the plant's main UPS unit. Projects in the planning phase include the SVWTP Short-Term Improvements Project. The scope of work under this project will include replacement of the filter valves, sludge system piping, sodium hydroxide feed piping, filter air scour piping, cationic polymer piping, and feed pumps; repairs to address concrete spalling in the sedimentation basins; and repair or replacement of the sedimentation scraper equipment. These areas were identified by WSTD staff for replacement and upgrades to ensure continued reliability of the SVWTP. Other projects in planning include an evaluation to replace the existing sedimentation basin baffle walls with FRP walls. In addition, there is a large capital improvement project, currently at 35% design, to construct a new ozonation facility at SVWTP to remove T&O compounds associated with algal blooms in San Antonio and Calaveras Reservoirs; and to provide other water quality benefits, such as disinfection byproduct (DBP) reduction. This new facility will address long-term T&O control associated with algal blooms in San Antonio and Calaveras Reservoirs.

Condition. SVWTP is in good condition.

Pulgas Dechloramination Facility

Description. The purpose of the Pulgas Dechloramination Facility is to dechlorinate or dechloraminate the water discharged from the Pulgas Tunnel to the UCSR, while meeting NPDES permit requirements. The facility is immediately downstream of the Pulgas Pump Station and Balancing Reservoir. It has a treatment capacity of approximately 200 mgd and uses sodium hypochlorite, sodium bisulfite, and CO_2 to dechloraminate and adjust the pH of the receiving water prior to discharge.

Past upgrades to the facility included the replacement of the UPS unit and external bypass switches to improve UPS reliability during utility power interruptions. Projects in the design phase include replacement of the facility's rain gutters, which have corroded and deteriorated over the years.

Maintenance. Recent upgrades to the Pulgas Dechloramination Facility include the replacement of the UPS unit and external bypass switches to improve UPS reliability during utility power interruptions. Projects in the design phase include replacement of the facility's rain gutters, which have corroded and deteriorated over the years.

Condition. Pulgas Dechloramination Facility is in good condition.

Harry Tracy Water Treatment Plant

Description. HTWTP was originally constructed in San Bruno in 1972, and significant WSIP improvements were completed in 2014. HTWTP primarily supplies the high-pressure zone customers on the Upper Peninsula and San Francisco. When necessary, it can also supplement low-pressure zone customers through the pressure-reducing valve at Capuchino Valve Lot. Source water for HTWTP is pumped from Crystal Springs Reservoir to San Andreas Reservoir, where it is again pumped to the HTWTP. HTWTP is a 140 mgd direct filtration plant that provides

pre-oxidation with ozone, coagulation, flocculation, filtration through dual-media filters, fluoridation, corrosion control, and disinfection with sodium hypochlorite and ammonia to form chloramines. Significant improvements were made at HTWTP during WSIP to mitigate concerns about meeting LOS goals and objectives. In particular, the chlorine contactor and the 11-million-gallon treated water reservoir were situated on more stable ground. The treated water reservoir has a foundation supported by more than 800 piles driven down 12 to 61 feet to bedrock. Additional improvements included upgrades to the sludge-handling process, a new washwater tank, a new substation, switchgear, and motor control center (MCC). The conveyance structures that bring water from San Andreas Reservoir to HTWTP were rebuilt to comply with the latest seismic code.

Filter Underdrain

HTWTP has six existing filter underdrains that were originally constructed in 1972 and renovated in 1992. In 2009, as part of the HTWTP Short-Term Improvements Project, these filter underdrains were retrofitted, receiving plastic block underdrains with porous plate media retaining caps . In 2019 and 2020, two of the filters experienced a failure, during which several underdrain blocks were dislodged from the filter floor, allowing filter media and unfiltered water to enter the filter gullet. All six filters were taken out of service as a precaution. Currently, HTWTP relies on the remaining nine filters, which have a nozzle with plenum underdrain configuration, to meet the water production demand. From 2020 through 2022, failure analysis, alternative analysis, conceptual engineering, and design were completed for this project. The proposed modifications include installing new stainless steel underdrain systems, anchoring the six existing filters to the filter floor, replacing existing air distribution pipes and pipe supports within the filter flumes of each of the filters, and connecting to the existing air distribution system. Other miscellaneous modifications include coating and lining repair work, and concrete repair work. The construction phase is expected to start in late 2022 and extend for 1 year.

Maintenance. Numerous improvements to the plant's backup power supply system have been completed. The diesel particulate filters on the plant's three existing standby generators have been replaced with active type filters that rely on less load and heat to regenerate the filters, thereby improving filter performance and maintaining efficient removal of particulate matter from the generators. The hardware and software for the generator controls system were also recently upgraded for improved monitoring and control via SCADA. At HTWTP's existing washwater clarifiers, new mixers, spray nozzle systems, and level sensors have been installed for improved performance and monitoring, and reduced sludge buildup. There have also been smaller R&R projects in the last 2 years, addressing the overall reliability of HTWTP. These projects included rebuilding one of the raw water pump station motors; and corrosion repair of the access hatches above the treated water reservoir.

Projects in the construction phase include providing auto-flushing for the sludge transfer pumps with PLC consolidation, repairing and rebuilding one of the standby generators, and performing electrical switchgear PM work.

Upcoming projects currently in design include HVAC replacement for the Ozone Building server room; an upgraded fire-suppression system at the raw water pump station and Ozone Building server room; replacement of the diesel fuel polishing units and diesel fuel double containment piping; new vibration monitoring and alarm equipment for the raw water pumps; internal corrosion repair of the existing high rate washwater clarifiers; and replacement of old valve

actuators on the chemical tanks at the east chemical storage area. In addition, there is a capital improvement project, currently in the bid and award phase, to replace the filter underdrains and media for six existing filters at HTWTP.

Condition. HTWTP is in fair condition. The HTWTP Filters No. 1 to 6 Underdrain Replacement Project will replace the existing filter underdrains with new stainless steel underdrains. Completion of the underdrain replacement project will restore HTWTP's treatment and delivery capacity to prior to the filter underdrain failures.

RGSR Groundwater Production Wells

Description. Though not one of the six major water treatment facilities in RWS, the RGSR wells are water supply and treatment facilities added to RWS in the last couple of years. To meet dry-year delivery needs and diversify water supply options during nondrought and drought periods, SFPUC has constructed groundwater wells that connect to the San Francisco Water System (SFWS) and RWS under WSIP. These wells are operated as two separate systems: (1) San Francisco Groundwater Supply Project and (2) RGSR. Groundwater treatment for the nine SFPUC wells will take place at seven chemical feed and monitoring facilities. The four wells that connect to Daly City's and Cal Water's systems will receive treatment from their respective utilities. Groundwater treatment varies among the different well sites based on source water quality conditions and may include chloramination, pH adjustment, fluoridation, blending for chromium VI and nitrate, and blending or filtration for manganese. Planning is underway to design and construct additional treatment facilities for removing naturally occurring ammonia in groundwater from a few wells.

Eight wells have received permit approval from SWRCB for conditional use. Start-up testing has been completed at these eight wells. From 2020 to 2021, the wells supplied water to the RWS as part of start-up testing and extended testing. The conditional use permit from SWRCB requires quarterly monitoring of Title 22 parameters for 1 year, and monthly bacteriological monitoring for 18 months of the raw well water. This required monitoring was started soon after each well had successfully completed the start-up testing and is expected to be completed by the end of 2022.

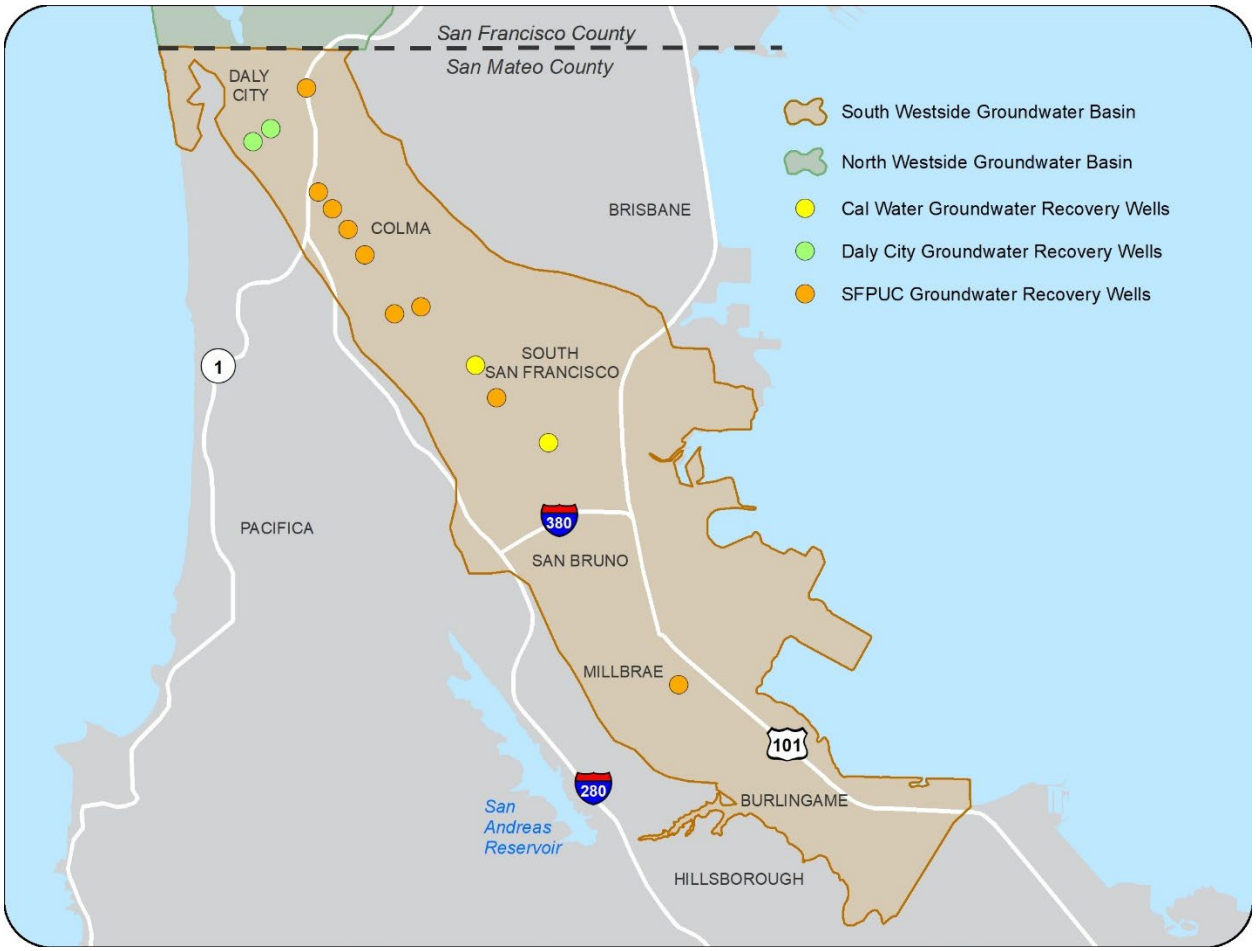
There are still outstanding decisions to be made for the long-term operating strategy of the RGSR wells. The Final RGSR Well Operations Plan, reflecting the future operating strategy, will be updated and submitted to SWRCB by the end of 2022.

Maintenance. Functional testing has been completed for all nine RGSR well sites. Extended testing (i.e., 7-week testing) was completed for the Millbrae and Trio (F Street, B Street, and Colma Boulevard) well stations in the summer and fall of 2021. In the short term, SFPUC intends to operate these four wells as a source of supply for RWS in dry years and will maintain them as active wells For the long term, SFPUC plans to phase in the implementation and operation of eight to nine wells through centralized blending and/or treatment. Several alternatives are being assessed, including sending groundwater to San Andreas Reservoir for blending and buffering, followed by treatment at HTWTP; treating groundwater at a new centralized blending and treatment facility on the Peninsula; and other hybrid alternatives.

Condition. RGSR groundwater production wells are in good condition, with further improvements scheduled under forthcoming phases. With the construction and commissioning

of select groundwater facilities completed under Phase 1, the RGSR project has transitioned into the next phase of construction (Phase 2A). This phase of construction focuses on the implementation of additional O&M improvements for select groundwater facilities. This work includes the addition of flowmeters, variable-frequency drives (VFDs) for existing well pumps, surge anticipation valve modifications, and cathodic protection for wells.

Figure 4-1: Location of RGSR Groundwater Wells



4.2.2.2 Capital Improvements

Regional Water currently has seven active capital projects for its water treatment assets, representing a total capital investment of $340 million. Regional Water also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the seven active large capital projects are provided in the following sections.

Sunol Valley Chloramination Facility Project (Approved Budget: $9.99 Million; Substantial Completion: 2024)

Scope. The primary objective of the project is to increase reliability at the fluoridation facility, SVF, and Dechlorination Facility. The scope of the project includes (1) addressing various deficiencies of the chemical feed systems, controls, and related equipment, which will lower the current maintenance costs of the existing equipment; (2) redesign and commission of the Dechlorination Facility; and (3) upgrade of the main PLC at SVCF to provide better reliability, security, and support for the replaced pump local control panels.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-26.

Table 4-26: Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Environmental Review	December 31, 2020
65% Design	January 29, 2022
95% Design	May 24, 2022

SVWTP Ozone Project (Approved Budget: $192.82 Million; Substantial Completion: 2026)

Scope. This treatment project involves the installation of a raw water ozonation system at SVWTP to control T&O events. Other major components of this project include (1) 10-inch to 66-inch-diameter piping, elbows, and valves; (2) concrete valve vaults; (3) ozone generator and electrical buildings; (4) loop colling water systems, liquid oxygen vaporizer systems, ozone generators, injector systems, contact basin, and destruct systems; (5) pre-chloramination facilities for bromate control; (6) instrumentation and controls and shop space; (7) solar panels, standby power systems, and high-voltage and electrical equipment and distribution systems; (8) minor Calaveras Substations upgrades to support the ozone facility power needs; and (9) underground utilities and site improvements.

Milestones Completed During the Reporting Cycle. The milestone achieved by this project during this reporting cycle is summarized in Table 4-27.

Table 4-27: Sunol Valley Water Treatment Plant Ozone Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Conceptual Engineering Report	December 30, 2021

Sunol Valley Water Treatment Plant Short-Term Improvements (Approved Budget: $60.03 Million; Substantial Completion: 2026)

Scope. Short-term upgrades were identified through condition assessments, operations staff observations, review of LOS, subsequent feasibility studies, and alternative analyses at SVWTP. These upgrades include (1) structural and HVAC improvements at the Administration Building; (2) remodeling of the Water Quality Lab at the Administration Building, including cabinet,

countertop, sink, plumbing, and flooring replacement, along with mold remediation work; (3) repairs to concrete spalling in the sedimentation basins; (4) replacement of leaking washwater drain valves, upgrading of the washwater tank and access system, and installation of a valve actuator; (5) upgrading of the sludge system piping, valves, and monitoring system; (6) upgrading of the chemical piping system; (7) remediation of leakage at the expansion joint around settled water pipes from sedimentation basin, and installation of a new fixed washdown system at the sedimentation basin; (8) replacement of flocculator VFDs for the flocculation basins; (9) replacement of corroded air scour piping and chlorine contact tank piping; (10) installation of new flowmeters for the washwater backwash system and chlorine contact tank; (11) installation of new lighting and plant intercom and paging systems; and (12) installation of a new server room fire suppression system and plate settler washdown piping system.

Milestones Completed During the Reporting Cycle. The milestone achieved by this project during this reporting cycle is summarized in Table 4-28.

Table 4-28: Sunol Valley Water Treatment Plant Short-Term Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Project planning in progress	Pending

Sunol Valley Water Treatment Plant Long-Term Improvements (Approved Budget: $10.5 Million; Substantial Completion: 2026)

Scope. Long-term upgrades were identified through condition assessments, operations staff observations, review of LOS, subsequent feasibility studies, and alternative analyses at SVWTP. These upgrades include (1) installation of an emergency eyewash station at the chlorine contact tank; (2) repairs to bird netting deficiencies at the flocculation/sedimentation basins and filters; (3) installation of new bird netting for fluoride storage and the chemical delivery dock; (4) replacement of main switchboards 1 and 2, removal of ATS-1, ATS-2, and ATS-3, and incorporation of functionality into the new switchgear; (5) addition of a redundant 2-megawatt (MW) standby generator with active particulate air filters; (6) replacement of all General Electric power circuit breakers (not all are arc-flash-rated); (7) repairs to the concrete pad and coating at the caustic tank farm; (8) reconfiguration of the Cat-C polymer feed system; (8) installation of the washwater pumps soft starter system; (9) installation of air monitors for the aqua ammonia tanks; and (10) roadway and site improvements.

Milestones Completed During the Reporting Cycle. No major milestones were achieved by this project during this reporting cycle, but the planning phase continued.

Table 4-29: Long-Term Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Project planning in progress	Pending

Sunol Valley Water Treatment Plant Polymer Feed Facility Project (Approved Budget: $19.05 Million; Substantial Completion: 2024)

Scope. At SVWTP, the new flocculation/sedimentation basin built in 2013, as well as the other four existing basins that are each rated at a capacity of 40 mgd, were not able to achieve their capacity under all operating and water quality scenarios. A new flocculant aid and polymer system will be built, including (1) polymer feed building with polymer totes and a tote storage area; (2) polymer blending units; (3) batch tanks, tank and tote mixers, and batch tanks polymer transfer pump; (4) polymer feed pumps, piping, and valving; and (5) site improvements.

Milestones Completed During the Reporting Cycle. The milestone achieved by this project during this reporting cycle is summarized in Table 4-30.

Table 4-30: Sunol Valley Water Treatment Plant Polymer Feed Facility Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
35% Design	August 17, 2020

HTWTP Filter Underdrain Replacement Project (Approved Budget: $14.4 M; Substantial Completion: 2023)

Scope. Underdrains in two filters in a bank of six have failed since 2019, and replacement of the underdrains is being prioritized to restore HTWTP's treatment capacity and reliability. The project includes (1) removal and disposal of existing filter media, and provision of new filter media; (2) procurement and installation of new stainless steel filter underdrains for six filters; (3) modification of air distribution piping beneath filter underdrains; (4) cleaning and recoating of main air distribution piping; and (5) demolition work and concrete work.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-31.

Table 4-31: HTWTP Filter Underdrain Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	May 5, 2021
Conceptual Engineering Report	May 7, 2021
50% Design	September 2021
95% Design	December 2021
100% Design	May 2022
Bid and Award	June 2022 (bids received)

Notes:
AAR = Alternatives Analysis Report
HTWTP = Harry Tracy Water Treatment Plant

Regional Groundwater Treatment Improvements Project (Approved Budget: $38.6; Substantial Completion: 2028)

The purpose of this project is to improve the performance of the Regional Groundwater Wells and treatment systems in the South Westside Basin for reliable use during dry years. In normal and wet years, SFPUC will supply treated surface water to Daly City, San Bruno, and Cal Water, to be used in place of their typical groundwater supply, thereby increasing the volume of groundwater in storage that can be pumped as supplemental water in dry years. This project will address emerging well water quality issues that require treatment; will provide additional reliability for treatment systems at the wells; and will evaluate the potential for a consolidated treatment facility (through alternatives analysis only). If a centralized treatment alternative is selected, the estimated project cost could potentially be $250 million, which includes construction of approximately 14 miles of 8-inch- to 24-inch-diameter pipeline, a pump station, storage tanks, treatment facilities, and other ancillary facilities.

Scope. The current project consists of design and construction of facilities at individual well sites, including (1) installation of an ammonia analyzer at one site; (2) construction of manganese enclosures at two sites; (3) installation of a building, filtration, and ammonia analyzer at one site; (4) upsizing of pedestals and tanks for 2-week storage of sodium hydroxide at five sites; (5) upsizing of pedestals and tanks for 2-week storage of liquid ammonium sulfate at seven sites; (6) upsizing of a pedestal and tank for 2-week storage of sodium hypochlorite at one site; (7) installation of a detention (contact) tank to address high levels of ammonia without enclosure at one site; (8) upsizing of pedestals, tanks, and overall chemical systems for a change in chemical concentration from 50 percent to 25 percent at five sites; (9) installation of a chlorine detention (contact) tank to address high levels of ammonia; (10) installation of Venturi meters or mag meters with dismantling joint inside concrete vault at six sites; (11) removal of bucket elevators for sodium fluoride at seven sites; (12) a study to compare liquid versus powder fluoride; (13) a study of reverse flow (lockout study for minimum shutdown time); and (14) reimbursement to Cal Water for supporting the project design and construction for the South San Francisco Main well.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-32.

Table 4-32: Regional Groundwater Treatment Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Decentralized Regional Groundwater Treatment Improvements Final Technical Memorandum	February 18, 2022
Regional Groundwater Treatment Evaluation Final Report	February 22, 2022

Summary of Levels of Service Impacts

LOSs that are supported by the RWS water treatment capital improvements are provided in Table 4-33.

Table 4-33: RWS Water Treatment Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
SVCF Project	✓		✓					
SVWTP Ozone Project	✓							
SVWTP Short-Term Improvements	✓		✓					
SVWTP Long-Term Improvements	✓		✓					
SVWTP Polymer Feed Facility Project	✓		✓					
HTWTP Filter Underdrain Replacement Project	✓		✓					
Regional Groundwater Treatment Improvements Project	✓					✓		

Notes:

HTWTP = Harry Tracy Water Treatment Plant
RWS = Regional Water System
SVCF = Sunol Valley Chloramination Facility
SVWTP = Sunol Valley Water Treatment Plant

4.3 Water Transmission Assets

SFPUC owns and operates multiple water transmission assets, including tunnels, penstocks, and pipelines. The responsibility for O&M of these assets is divided geographically between both HHWP and Water Supply and Treatment.

4.3.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of multiple water transmission assets that work as a system to transport water from the Sierra Nevada Mountains to the AEP, spanning nearly the entire width of California. These assets include:

Canyon Power Tunnel
Canyon Portal Valve House
Kirkwood Penstock
Early Intake Bypass Tunnel and Pipeline
Eleanor-Cherry Tunnel
Cherry Power Tunnel
Granite Portal Valve House
Holm Penstock
Lower Cherry Aqueduct
Mountain Tunnel
Moccasin Power Tunnel
West Portal Valve House
Moccasin Penstock
Foothill Tunnel
San Joaquin Pipelines
San Joaquin Valve House
Coast Range Tunnel

4.3.1.1 Asset Descriptions, Maintenance, and Condition

Descriptions of the HHWP water transmission assets, along with summaries of their maintenance and condition, are provided in the following sections, organized from upstream to downstream. A summary of the assets organized by classification is included in Appendix A, in the Upcountry section of Table A-6.

Canyon Power Tunnel

Description. Canyon Power Tunnel, built in 1965, is a 10.8-mile-long tunnel that conveys water from O'Shaughnessy Dam to Kirkwood Penstock. The majority of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14.5 feet. Canyon Power Tunnel includes two adits: North Mountain and Hetchy Adit.

Maintenance. Table 4-34 summarizes maintenance work.

Table 4-34: Canyon Power Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; not inspected during the reporting cycle
	Completed weekly	Adit and adit leakage monitored.
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Canyon Power Tunnel is in good condition. It was last inspected in 2009, and the schedule for the next inspection will be determined in the next reporting cycle. During this reporting cycle, no new deficiencies were noted, and the tunnel is fit for service; however, Hetchy Adit requires capital improvements, and a project is currently in progress.

Canyon Portal Valve House

Description. Canyon Portal Valve House is upstream of Kirkwood Penstock and downstream of Canyon Tunnel. Inside the valve house there is a single 96-inch-diameter butterfly valve, as well as the mechanical and electrical equipment necessary for its operation.

Maintenance. Table 4-35 summarizes maintenance work.

Condition. Canyon Portal Valve House is in good condition; however, improvements are recommended to its instrumentation and control components. One of the functions of the Canyon Portal Valve House is to provide protection to the Kirkwood Penstock and Kirkwood Powerhouse in the event of a penstock failure. The system has instrumentation and control installed that would identify the failure event and close the valve, stopping flows to the Kirkwood Penstock. During this reporting cycle, there were multiple events when the valve closed unnecessarily. HHWP crews were able to successfully restore the system without interruption to water deliveries, and adjustments were made to the instrumentation and control to help prevent future events; however, it is recommended that this be further evaluated. Canyon Portal Valve House is fit for service.

Table 4-35: Canyon Portal Valve House Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Trip Test	Completed weekly	Perform trip test of valve
Inspection	Completed annually	Mechanical inspection of valve, actuator, and associated equipment; valve stems are greased.
	Completed weekly	Facility inspected by HHWP watershed keeper
Surveillance and Monitoring	Continuously monitored	Alarmed and monitored continuously via SCADA

Notes:

HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Kirkwood Penstock

Description. Kirkwood Penstock (formerly known as Canyon Penstock) is a coated steel pipe asset within the HHWP system that conveys water from Canyon Power Tunnel to Kirkwood Powerhouse. Constructed in 1967, the penstock is an essential component of SFPUC water and power reliability, in that it (1) serves as a direct passageway for primary source water from O'Shaughnessy Dam, with little to no redundancy; and (2) is a critical asset for power generation at Kirkwood Powerhouse.

Maintenance. Table 4-36 summarizes maintenance work.

Table 4-36: Kirkwood Penstock Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Inspected by HHWP watershed keeper for leaks, rockfall, and movement
Vegetation Management	Annually or as needed	Removal of vegetation to reduce fire danger and ease inspections
Surveillance and Monitoring	Continuously monitored	Pressure and flows monitored continuously via SCADA alarms; penstock movement is monitored and alarmed

Notes:

HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Kirkwood Penstock is in good condition; however, due to its historical stability performance, HHWP monitors the upper reach of the penstock for movement using an automated system. The system was installed in 2018 as a series of risk mitigation measures that were implemented to extend the life of the asset. During the inspection and monitoring performed by HHWP in this reporting cycle, no deficiencies were noted, and all recorded

movements were within the established thresholds. Additionally, HHWP identified the couplings on Kirkwood Penstock as a "critical spare" item due to their technical design requirements and procurement lead time. HHWP completed the design and award of the procurement package, which included multiple large-diameter couplings for the penstock. The couplings are currently in fabrication and will be delivered to HHWP by the end of 2022. Kirkwood Penstock is fit for service.

Early Intake Bypass Tunnel and Pipeline

Description. The Early Intake Bypass Tunnel and Pipeline conveys water from Kirkwood Powerhouse directly into the Mountain Tunnel. The bypass consists of a tunnel on the northern side of the Tuolumne River, leading to a steel pipe crossing the river to Mountain Tunnel on the southern side. The 1,725-foot tunnel is horseshoe-shaped, varying in diameter from 10 feet to 14.6 feet. The water exits the Early Intake Bypass Tunnel, entering a 293-foot long, 9.5-foot-diameter pipeline that crosses over the Tuolumne River. There is an unused Venturi meter on the downstream end of the pipeline.

Maintenance. Table 4-37 summarizes maintenance work.

Table 4-37: Early Intake Bypass Tunnel and Pipeline Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspects tunnel for changes in wall conditions, weeps, and debris; pipeline lining inspected; not inspected during the reporting cycle
	Completed weekly	Above-ground sections and access inspected by watershed keeper for leaks
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Early Intake Bypass Tunnel and Pipeline is in good condition. During this reporting cycle, no deficiencies in condition were noted. An improvement to the Early Intake Bypass Pipeline was made to install a drain valve that could be used to monitor leakage during system shutdowns. The Early Intake Bypass Tunnel and Pipeline are both fit for service.

Eleanor-Cherry Tunnel

Description. Eleanor-Cherry Tunnel is a 1.1-mile-long tunnel that conveys water from Lake Eleanor to Lake Lloyd (a.k.a. Cherry Lake). The tunnel is horseshoe-shaped, and it measures approximately 8.5 feet by 8.5 feet.

Maintenance. Table 4-38 summarizes maintenance work.

Table 4-38: Eleanor-Cherry Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; not inspected during the reporting cycle
Surveillance and Monitoring	Completed daily	Flows estimated daily via mass balance

Note:
PM = preventive maintenance

Condition. The Eleanor-Cherry Tunnel was last inspected in 2017 and is scheduled to be inspected again in 2027. The tunnel is in good condition and is fit for service.

Cherry Power Tunnel

Description. The Cherry Power Tunnel is a 5.6-mile-long tunnel that transmits water from Lake Lloyd (aka Cherry Reservoir) through Granite Portal to Holm Penstock.

Maintenance. Table 4-39 summarizes maintenance work.

Table 4-39: Cherry Power Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; not inspected during the reporting cycle
	Completed weekly	Adit inspections
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Cherry Power Tunnel is in good condition and fit for service. The tunnel was last inspected in 2000, and the next inspection is scheduled for 2025.

Granite Portal Valve House

Description. Granite Portal Valve House is upstream of Holm Penstock and downstream of Cherry Power Tunnel. Inside the valve house there is a single 96-inch-diameter butterfly valve, as well as the mechanical and electrical equipment necessary for its operation.

Maintenance. Table 4-40 summarizes maintenance work.

Table 4-40: Granite Portal Valve House Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Trip Test	Completed weekly	Perform trip test of valve
Inspection	Completed annually	Mechanical inspection of valve, actuator, and associated equipment; valve stems are greased
	Completed weekly	Facility inspected by HHWP watershed keeper
Surveillance and Monitoring	Continuously monitored	Alarmed and monitored continuously via SCADA

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Granite Portal Valve House is in good condition and remains fit for service. One of the functions of the Granite Portal Valve House is to provide protection to the Holm Penstock in the event of a penstock failure, similar to Canyon Portal Valve House's function for Kirkwood Penstock. The system has instrumentation and control installed that would identify the failure event and close the valve, stopping flows to the Holm Penstock. It is recommended that the instrumentation and control assets be assessed and improved as necessary at Granite Portal Valve House, similar to what was recommended for Canyon Portal Valve House.

Holm Penstock

Description. Holm Penstock (formerly known as Cherry Penstock) is a coated steel pipe asset within the HHWP system that conveys water from Cherry Power Tunnel to Holm Powerhouse. Constructed between 1959 and 1962, the penstock is a critical component of SFPUC water and power reliability in that it (1) serves as a direct passageway for primary source water from Lake Lloyd (aka Cherry Reservoir, with no redundancy; and (2) is a critical asset for power generation at Holm Powerhouse.

Maintenance. Table 4-41 summarizes maintenance work.

Table 4-41: Holm Penstock Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Inspected by HHWP watershed keeper for leaks, rockfall, and movement
Vegetation Management	Annually or as needed	Removal of vegetation to reduce fire danger and ease inspections
Surveillance and Monitoring	Continuously monitored	Pressure and flows monitored continuously via SCADA alarms

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Holm Penstock was last inspected in 2013 after the Rim Fire and is in good condition. The exterior coating of the penstock is nearing the end of its life and should be repaired so it can continue to protect the steel from the elements. Holm Penstock is fit for service.

Lower Cherry Aqueduct

Description. The LCA provides SFPUC with access to either Lake Lloyd or Lake Eleanor storage for drinking water purposes in an emergency or drought condition. The LCA includes a small diversion dam on Cherry Creek that routes releases from the Cherry and Eleanor watersheds through a series of tunnels, open canals, and steel pipeline to Early Intake Reservoir.

Maintenance. Table 4-42 summarizes maintenance work.

Table 4-42: Lower Cherry Aqueduct Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed biweekly	Inspected by HHWP watershed keeper for leaks, rockfall, and movement
Vegetation Management	Annually or as needed	Removal of vegetation to reduce fire danger and ease inspections
Flush and gate operation	Completed annually	Aqueduct operated annually, pushing water though all gates, tunnels, canals, and pipes; leaks and constrictions are monitored and fixed

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance

Condition. The LCA is in good condition because multiple maintenance and capital improvements were made over the last 4 years. The LCA is fit for service.

Mountain Tunnel

Description. Mountain Tunnel is a critical water conveyance facility for the Hetch Hetchy System source. Built between 1917 and 1925, Mountain Tunnel extends 19.2 miles from Early Intake Dam to Priest Reservoir. The majority of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14.5 feet. The first 7.2 miles of Mountain Tunnel west from Early Intake are unlined, with the exception of small, lined areas at each adit and a short section approximately 400 feet east of South Fork Adit. Nine of the remaining 12 miles of tunnel are lined.

Maintenance. Table 4-43 summarizes maintenance work.

Condition. Mountain Tunnel is currently in only fair condition due to its age and the deficiencies that were noted in recent condition assessments, most notably related to failure of the concrete lining. Improvements to the liner as well as additional improvements are being addressed by the active capital improvement project, which is currently in construction.

Table 4-43: Mountain Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; visually inspected in 2021 during construction
	Completed weekly	Adit inspections, with exception of South Fork Adit
	Completed monthly	South Fork Adit inspection
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Moccasin Power Tunnel

Description. Moccasin Power Tunnel is a 1-mile-long tunnel that conveys water from Priest Reservoir to the Moccasin Penstocks. Most of the tunnel is horseshoe-shaped, and it measures approximately 13 feet by 13 feet.

Maintenance. Table 4-44 summarizes maintenance work.

Table 4-44: Moccasin Power Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; performed in 2020
	Completed weekly	Adit inspections
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. A maintenance inspection of Moccasin Power Tunnel was completed in 2019, and a condition assessment is scheduled in 2024. The Moccasin Power Tunnel is in good condition and remains fit for service.

West Portal Valve House

Description. West Portal Valve House is upstream of Moccasin Penstock and downstream of Moccasin Power Tunnel. Inside the valve house there are three 104-inch-diameter butterfly valves, as well as the mechanical and electrical equipment necessary for their operation.

Maintenance. Table 4-45 summarizes maintenance work.

Table 4-45: West Portal Valve House Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Valve Trip Test	Completed weekly	Perform trip test of valve
Inspection	Completed annually	Mechanical inspection of valve, actuator, and associated equipment; valve stems are greased
	Completed weekly	Facility inspected by HHWP watershed keeper
Surveillance and Monitoring	Continuously monitored	Alarmed and monitored continuously via SCADA

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. West Portal Valve House is in only fair condition due to its age. Historically, the valve house was used as an isolation point for maintenance and construction on Moccasin Penstock; however, improved safety practices no longer rely on single butterfly valves as an isolation point. It is recommended to investigate this further to determine whether improvements are appropriate to provide access inside Moccasin Penstock while the Moccasin Power Tunnel remains in service.

Moccasin Penstock

Description. Moccasin Penstock is set of coated steel pipes within the HHWP system that conveys water from Priest Reservoir to Moccasin Powerhouse. Constructed in 1924, with new sections completed in 1969, the penstock is an essential component of SFPUC water and power reliability in that it (1) serves as a direct passageway for primary source water from Hetch Hetchy Reservoir, with little redundancy; and (2) is a critical asset for power generation at Moccasin Powerhouse.

Maintenance. Table 4-46 summarizes maintenance work.

Table 4-46: Moccasin Penstock Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Inspected by HHWP watershed keeper for leaks, rockfall, and movement
Vegetation Management	Annually or as needed	Removal of vegetation to reduce fire danger and ease inspections
Surveillance and Monitoring	Continuously monitored	Pressure and flows are monitored continuously via SCADA alarms

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Moccasin Penstock is in fair condition, given its age and deficiencies in its anchor bocks, lining, and coatings. Additional investigation is also recommended on its riveted joints and couplings. The penstock remains fit for service; however, it needs capital improvement.

Foothill Tunnel

Description. Foothill Tunnel is a 16.3-mile-long tunnel that conveys water from Moccasin Reservoir to Oakdale Portal, the entrance to the SJPLs. Most of the tunnel is horseshoe-shaped, and it measures approximately 14 feet by 14 feet. About half of the of the tunnel is unlined rock. The tunnel crosses beneath Don Pedro Reservoir via the Red Mountain Bar Siphon. Between the siphon and Oakdale Portal, the Rock River Lime Plant adjusts the water pH at the Rock River Shaft.

Maintenance. Table 4-47 summarizes maintenance work.

Table 4-47: Foothill Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; not inspected during the reporting cycle
	Completed monthly	Inspection and exercise blowoffs at Brown and Pedro adits
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. A condition assessment of Foothill Tunnel was performed in 2020. Foothill Tunnel is in good condition and fit for service. The next condition assessment is planned for 2030.

San Joaquin Pipelines

Description. There are four SJPLs, but only three (SJPL Nos. 1, 2, and 3) extend the entire 47.5 miles across the San Joaquin Valley. SJPL No. 4 has a 6.7-mile-long eastern reach, beginning at Oakdale Portal; and a 10.5-mile-long western reach, ending at Tesla Portal. The SJPLs were constructed over an 80--year period. SJPL Nos. 1 through 4 were completed in 1934, 1953, 1968, and 2014, respectively. The purpose of the pipelines is to convey Hetch Hetchy water across the San Joaquin Valley, from Foothill Tunnel to CRT. Ancillary facilities, such as throttling stations, crossover valve vaults, metering facilities, and pressure-relief facilities are part of the overall SJPL network.

Maintenance. Table 4-48 summarizes maintenance work.

Table 4-48: San Joaquin Pipelines Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Internal Inspection	Completed as needed; sections of SJPL Nos. 2 and 3 were inspected in 2021.	HHWP Water Operations and Engineering inspect for lining condition, leaks, valve condition
External Inspection	Completed weekly	Facility inspected by HHWP watershed keeper
Valve Box Maintenance	Completed every 10 months	Blowoff valve and air valve operation
Surveillance and Monitoring	Continuously monitored	Pipeline pressure, flow, and turbidity alarmed and monitored continuously via SCADA; SJPL No. 3, Section A, monitored for wire breaks

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition
SJPL = San Joaquin Pipeline

Condition. The four SJPLs are currently undergoing a systemic condition assessment. The electro-magnetic in-line inspection of SJPL No. 1 was completed in 2021, and the data are currently being processed. Preliminary results indicate significant pipeline wall thinning due to corrosion. Pipeline relining, repairs, and sectional replacements are being planned to efficiently improve pipeline reliability. Condition assessments of SJPL Nos. 2, 3, and 4 will be completed between 2023 and 2026. Spot visual inspections of SJPL Nos. 2, 3, and 4 indicate that the pipeline is in serviceable condition. SJPL Nos. 1, 2, 3, and 4 are fit for service; however, SJPL No. 1 will require significant capital improvements in the coming years.

SJPL Valve Houses

Description. A series of valve houses and throttling stations along the SJPLs are used to isolate and control flows through the SJPLs. These include Oakdale Portal, Throttling Station 3/4, Throttling Station 2 East, Throttling Station 2 West, P4J, Emery Crossover, Albers Valve House, Roselle Crossover, San Joaquin Valve House, Pelican Crossover, Tesla UV Valve House, Tesla Portal 1/2 Valve House, and Tesla Portal 3 Valve House. The valve houses are remotely monitored and supervised from Moccasin Control Center.

Maintenance. Table 4-49 summarizes maintenance work.

Condition. There are eight valve houses providing isolation and flow control through the SJPLs. The original valve houses at Tesla, San Joaquin, and Oakdale are fit for service and in fair condition. The remaining five valve houses were constructed during the SJPL No. 4 construction, circa 2010, and are in good condition. In 2021, the PLCs and remote terminal units were upgraded in the San Joaquin Valve House to improve supervisory monitoring and controls. Unfortunately, due to valves that are not rated for the required pressures and an overall lack of redundancy, the valve houses do not provide adequate isolation to support work inside the pipelines unless the entire Hetch Hetchy System is shut down.

Table 4-49: San Joaquin Pipeline Valve Houses Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Internal Inspection	Completed as needed	Inspection of lining, leaks, and valve condition; Oakdale Portal Valves inspected in 2021
	Weekly	Facility inspected by HHWP watershed keeper
Maintenance	Completed quarterly	Operate and inspect valves, including actuators and manual handwheels
Surveillance and Monitoring	Continuously monitored	Facilities have security alarms that are monitored continuously; pipeline pressure and flow are alarmed and monitored continuously via SCADA

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Coast Range Tunnel

Description. CRT is a 25.1-mile-long tunnel that conveys partially treated Hetch Hetchy water from TTF, just downstream of the SJPLs, to AEP. The finished diameter of the lined tunnel is 10.5 feet. Six construction shafts were used to build the tunnel from 1927 to 1934. All of the shafts were backfilled, except for the Thomas Vent Shaft, which connects the tunnel with the ground surface.

Maintenance. Table 4-50 summarizes maintenance work.

Table 4-50: Coast Range Tunnel Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Scheduled every 10 years	Inspect for changes in wall conditions, weeps, and debris; not inspected during the reporting cycle
Surveillance and Monitoring	Continuously monitored	Turbidity, pressure, and flows monitored continuously via SCADA alarms

Notes:
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. CRT was last inspected in 2015 and is scheduled to be inspected again in 2035. The tunnel is in good condition and is fit for service.

4.3.1.2 Capital Improvements

HHWP currently has seven active capital projects on its water transmission assets, representing a total capital investment of $445.2 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the active large capital projects are provided in the following sections.

SJPL Tesla Valves Replacement (Approved Budget: $3.7 Million; Substantial Completion: 2022)

Scope. The project will involve replacing one large-diameter butterfly valve (TUV 101) inside the Tesla Valve Vault so that the SJPL No. 1 can be safely isolated without requiring shutdown of the entire system. This will improve safety when entering the pipeline for maintenance and inspection purposes.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-51.

Table 4-51: SJPL Tesla Valves Replacement Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
Completed 100% Design	December 2020
JOC 74-15 – Task Order Notice to Proceed for Valve Installation	April 2021
Completed Construction	March 2022

Note:
JOC = job order contract

SJPL Valve and Safe Entry Improvements (Approved Budget:$142.6 Million; Substantial Completion: 2027)

Scope. The objective of this project is to allow for safe entry into any and all sections of the SJPLs for inspection and maintenance while the remainder of the system stays in operation. The project will be completed in four phases: (1) Phase 1A – Pipeline 2 Tesla and Oakdale Entry Improvements; (2) Phase 1B – Pipelines 3 and 4 Tesla and Oakdale Entry Improvements; (3) Phase 2 – Pelican, Roselle, Emery and P4J Entry Improvements; and (4) Phase 3 – Tesla Surge Stack.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-52.

Table 4-52: SJPL Valve and Safe Entry Improvements Project Milestones Completed During the Current Reporting Cycle

Phase	Milestones	Completion Date
	Conceptual Engineering Report Rev C (Final)	March 29, 2021
Phase 1A	65% Design for HH-1005 (Phase 1A)	May 2021
	95% Design for HH-1005 (Phase 1A)	July 2021
	100% Design for HH-1005 (Phase 1A)	October 2021
	Issued Notice to Proceed for Constriction HH-1005 (Phase 1A)	May 2022
Phase 1B	65% Design for HH-1006 (Phase 1B)	July 2021
	95% Design for HH-1006 (Phase 1B)	October 2021
	100% Design for HH-1006 (Phase 1B)	February 2022
	HH-1006 Construction Contract Advertisement	April 2022
Phase 2	None	
Phase 3	65% Design (HH-1009)	March 2022
	95% Design (HH-1009)	May 2022

Mountain Tunnel Improvement Project (Approved Budget $238.6 Million; Substantial Completion: 2027)

Scope. The project provides design and construction of major tunnel repair and rehabilitation work; adit and tunnel entry improvements; access road improvements; and installation of a new flow-control facility at Priest Reservoir to ensure that the tunnel can reliably provide drinking water to customers for the next 100 years.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-53.

Table 4-53: Mountain Tunnel Improvement Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Construction Contract HH-1000R Award	October 13, 2020
Construction Contract HH-1000R Notice to Proceed	January 29, 2021
Excavation of the Priest Reservoir Flow-Control Facility	May 2021 to present
Priest Adit Tunnel excavation	April 2021 to present
Safety and road improvements: Adit 8/9 road, Adit 5/6 road, South Fork Road, and Rickson Road	March 2021 to present
Survey of tunnel and of siphon at South Fork; geological evaluation of South Fork siphon; installation of rock dowels at the Priest Adit Tie-In	2022 Shutdown (January through March)

Kirkwood Penstock (Approved Budget $3.5 Million; Substantial Completion: 2022)

Scope. The scope of the project included internal and external inspections, development of an EAP and Penstock Monitoring Plan, repairs to the damaged saddle, installation of a monitoring system, and procurement of emergency spare equipment.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-54.

Table 4-54: Kirkwood Penstock Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Purchase Order for Spare Bolt Split-Sleeve Couplings	February 2, 2022
Delivery of Spare Bolt Split-Sleeve Couplings	June 30, 2022

Cherry-Eleanor Pumps (Approved Budget $1.4 Million; Substantial Completion: Not Applicable)

Scope. The scope for this project is to complete an AAR and Conceptual Engineering Report to support the objective of replacing and upgrading the pumps in Cherry Pump Station with units that work with current operating strategies.

Milestones Completed During the Reporting Cycle. The project is scheduled and budgeted to begin in 2024; therefore, no milestones were achieved during this reporting cycle.

Canyon Tunnel Rehabilitation (Approved Budget $8.4 Million; Substantial Completion: 2026)

Scope. The scope for this project is to complete the installation of a new reinforced concrete plug downstream of the existing plug at the Hetchy Adit, to reduce leakage and increase the reliability of the system.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-55.

Table 4-55: Canyon Tunnel Rehabilitation Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Issued Notice to Proceed for PRO-0085.B task order to provide project support during planning, design, and construction	April 2022

Moccasin Penstock Rehabilitation (Approved Budget $47.3 Million; Substantial Completion: 2027)

Scope. The scope of this project includes rehabilitation of anchor blocks, penstock coating, penstock saddles, air valves, large-diameter butterfly valves, bifurcation sections, and flow meters; and upgrade of electrical systems, power transformers, the standby generator in West

Portal Valve House, and bulkhead isolation valves in the surge tower. The scope does not include the replacement of all hammer-forged welded steel pipe (WSP).

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-56.

Table 4-56: Moccasin Penstock Rehabilitation Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
External Inspection (JOC-074)	December 16, 2020
Internal Inspection (JOC-065R)	February 26, 2021
Condition Assessment Report (Final)	October 2021
Structural Evaluation Report (Draft)	May 27, 2021
Structural Evaluation Report (Final)	November 21, 2021
NAR	April 2022

Note:
JOC = job order contract
NAR = Needs Assessment Report

Summary of Levels of Service Impacts

LOSs that are supported by the HHWP water transmission capital improvements are provided in Table 4-57.

Table 4-57: HHWP Water Transmission Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
SJPL Tesla Valve Replacement			✓			✓		✓
SJPL Valve and Safe Entry Improvements			✓			✓		✓
Mountain Tunnel Improvement Project	✓		✓			✓		✓
Kirkwood Penstock			✓				✓	✓
Cherry-Eleanor Pumps			✓			✓	✓	✓
Canyon Tunnel Rehabilitation			✓				✓	✓
Moccasin Penstock Rehabilitation			✓				✓	✓

Notes:
HHWP = Hetch Hetchy Water and Power
SJPL = San Joaquin Pipeline

4.3.2 Regional Water

WSTD is responsible for the maintenance and operation of the large-diameter transmission pipelines west of the AEP to the terminal reservoirs in San Francisco. WSTD's water transmission system comprises pipelines and tunnels that range greatly in terms of installation date, pipeline material, pipeline condition, and operational importance. Current inventory is shown in Table A-6 in Appendix A. Figure 4-2 presents a graphical summary of pipeline and tunnel installations by material and installation date . A graphical representation of cumulative pipeline and tunnel inventory by material and installation date is shown on Figure 4-3.

Figure 4-2: Linear Feet of Pipelines and Tunnels by Material and Installation Decade

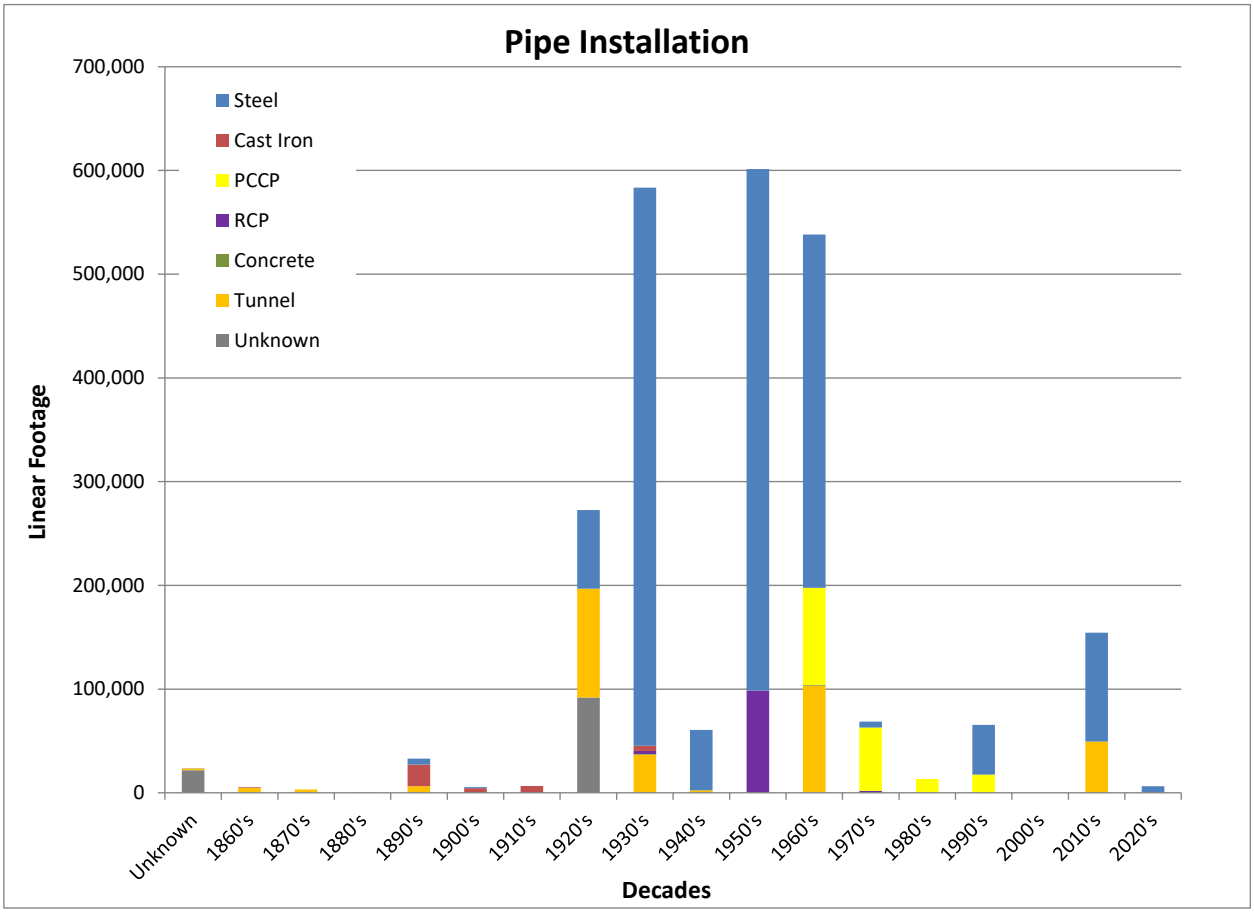
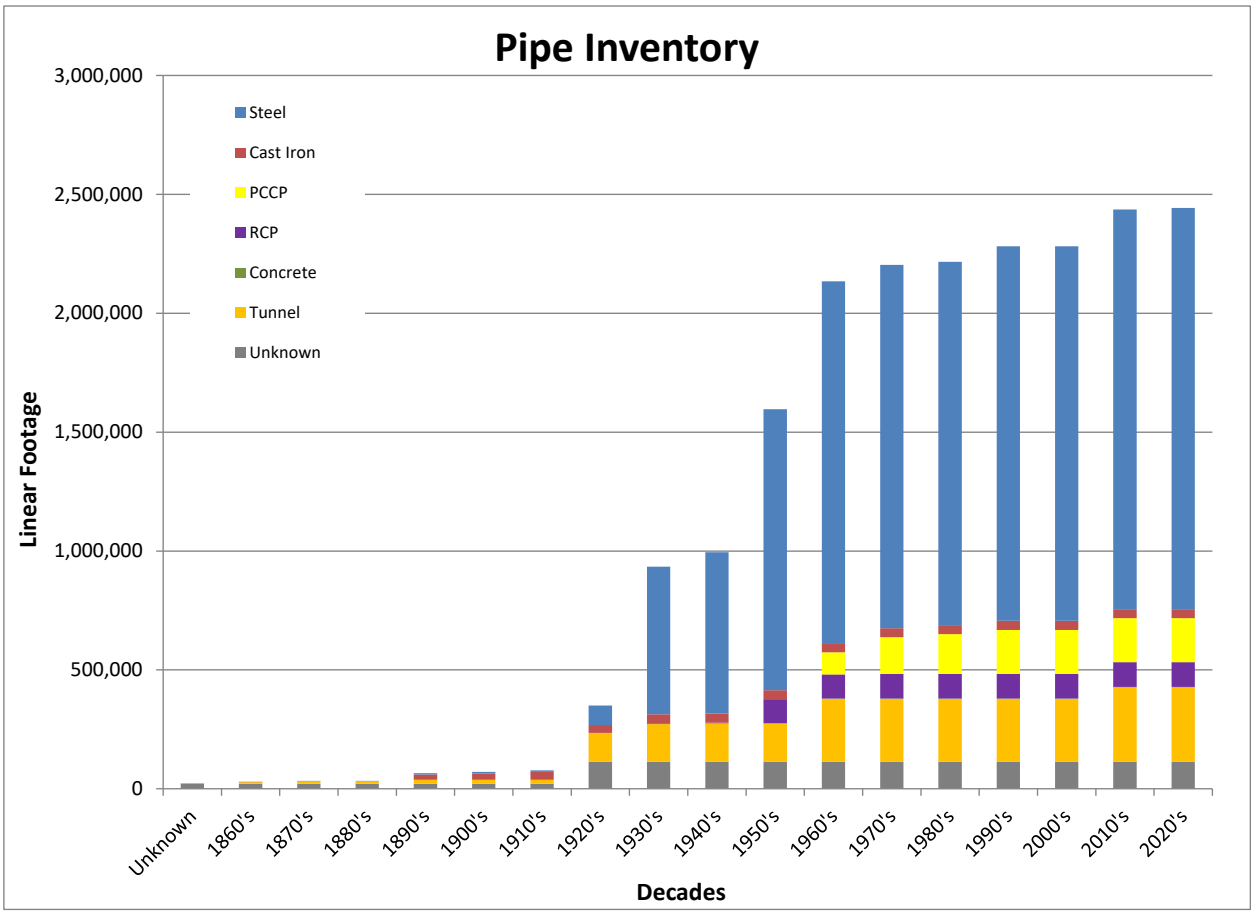


Figure 4-3: Cumulative Pipelines and Tunnels Inventory



Transmission projects completed by the Spring Valley Water Company between 1890 and 1930 were constructed using either cast iron or wrought steel. As of today, there are no cast iron pipelines remaining in RWS. The last reaches of RWS with cast iron construction were decommissioned in the fall of 2014, after the Bay Tunnel was brought into service. Joints for wrought-steel pipelines were riveted, as were the longitudinal seams that sealed the edges of the rolled-steel plates. Active pipelines from this period are a portion of the original SAPL No. 1, the 54-inch portion of CSPL No. 2, and BDPL No. 1.

For a brief period during the 1920s, design for large-diameter pipelines used a longitudinal mechanical "lockbar" that fastened the edges of rolled-steel plates, thus replacing longitudinal rivet courses. Only one such pipeline remains active, the 54-inch SAPL No. 2, constructed in 1928; SAPL No. 2 has riveted joints (except north of Merced Manor, where the pipeline is welded steel). Many sections of the lockbar pipeline are now being considered for replacement, following a major failure in July 2015 that revealed significant corrosion. In April 2019, construction for the replacement of approximately 6,500 linear feet of 54-inch lockbar pipeline was completed in the City of San Bruno.

WSP was developed in the early 1930s, and most construction contracts for RWS used WSP during this time. Longitudinal or spiral seams are welded in the shop during fabrication with an automatic arc-welding process. Circumferential joints are arc welded in the field by hand.

Also during the 1930s, reinforced concrete cylinder pipe (RCP) was developed: a steel cylinder with high-strength concrete cast on both sides of the cylinder and reinforcing steel bars embedded in the concrete outside the cylinder. Portions of BDPL Nos. 2 and 3, the upstream portion of BDPL No. 1, and Alameda Siphon No. 1 are RCP.

Prestressed concrete cylinder pipe (PCCP) was developed in the 1950s. The design used less steel in the pipe construction, resulting in a lower material cost. The savings were achieved by relying on high-strength wire wound to a high tension around a concrete core to develop compressive strength in the pipe. In the 1960s, SFPUC began to offer PCCP as an option to bidders for pipeline construction. Two sections of BDPL No. 4, Alameda Siphon No. 3, San Antonio Pipeline, CSPL No. 3, and the Crystal Springs Bypass Pipeline were constructed with PCCP, for a total of 28 miles, all completed by 1988. In addition, HHWP has approximately 6.25 miles of PCCP. Because PCCP can fail suddenly with catastrophic COF, SFPUC no longer considers PCCP as an option for new pipelines.

Based on current condition assessment data, most of the PCCP pipelines are shown to be in good condition and safe to operate; however, SFPUC intends to eventually replace the existing PCCP with WSP. To replace all PCCP in RWS would be a huge undertaking that will likely cost hundreds of millions of dollars. SFPUC will continue to operate the pipelines with PCCP but will perform inspections every 10 years to monitor for a change in condition.

Appendix A provides other pipeline and tunnel specifications, including length, capacity, and installation date. In addition to this report, SFPUC's "Data Book" (updated in 2011) provides extensive detail on pipelines and tunnels.

WSIP added seven new conveyance facilities: Alameda Siphon No. 4, San Antonio Backup Pipeline (SABPL), New Irvington Tunnel (Irvington Tunnel No. 2), BDPL No. 5, New Crystal Springs Bypass Tunnel, an extension of SAPL No. 3, and SJPL No. 4. Additionally, 16 sections of CSPL No. 2 were repaired. The 10-Year CIP also includes placeholder pipeline R&R projects. To date, these projects include replacement of additional reaches of SAPL No. 2 and additional repairs to CSPL No. 2 not covered under WSIP; additional seismic upgrades to SAPL Nos. 2 and 3 not covered under WSIP; lining repair to BDPL Nos. 1 through 4; and repair or replacement of BDPL No. 4, Sections A and D (PCCP sections).

4.3.2.1 Multi-Asset Maintenance Activities

Pipeline/Tunnel Maintenance Program and Condition Assessments

Regional Water has created a schedule for inspecting approximately 250 miles of pipeline over the next 20 years (see Appendix C.: 20-Year Pipeline Inspection Schedule). This schedule was created using a multi-step process based on a pipeline's likelihood of failure and the consequences of failure model. This process emphasized public safety by prioritizing inspections for pipelines that have the highest possibility of catastrophic failure and are near public or critical infrastructure.

Inspections on the schedule are listed by quarters (generally listing the first day of the quarter as a placeholder for the inspection in that quarter). Once the actual date is determined, the inspection date on the schedule changes accordingly. After pipelines have been inspected, the pipeline condition information from the inspection is used to make an informed decision when prioritizing Capital Improvements Projects.

The following scheduled inspections are planned for FY 23 and FY24:

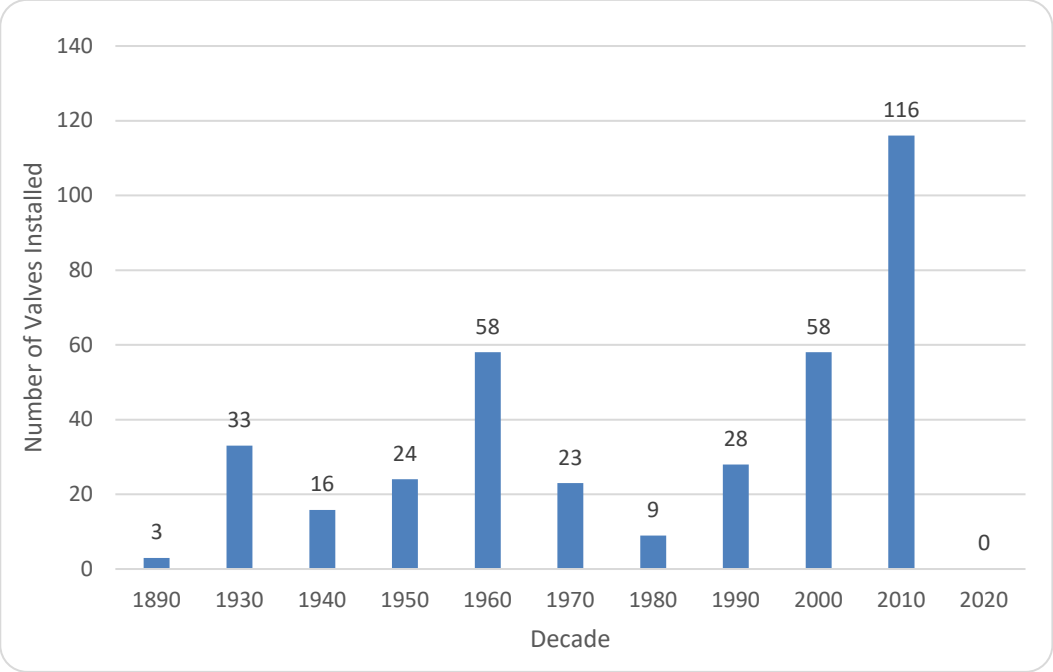
- SAPL No. 2 (Steel) R12 to R20
- BDPL No. 4 (PCCP), D10 to D20
- Palo Alto Pipeline (Steel), F6 to F60
- BDPL No. 3 (Steel), C26 to C40
- BDPL No. 4 (Steel), D26 to D40
- SSPL (Steel), M30 to M50
- Hillsborough Tunnel and SSPL (Steel), M20 to M30

Valve Maintenance Program and Condition Assessments

RWS includes more than 350 valves of various sizes, types, functions, and periods of installation. A complete 2022 inventory of main-line valves of the transmission system is shown in Table A-8 in Appendix A (a complete description for valves west of the CRT is housed in WSTD's Valve Book Database). Bypass valves and service connection valves are not included. Approximately 50 major valves were added under WSIP. In most cases, valves more than 50 years in age have been rebuilt or replaced.

Many new valve lots were added between 2001 and 2012 (Figure 4-4), just prior to and as part of WSIP. These include the cross-over valve lots on BDPL Nos. 3 and 4, where six facilities were completed, with the final two substantially completed in FY12. These valve lots significantly improve SFPUC's ability to operate around unplanned outages of one of these pipelines. The Paseo Padre and Grimmer valve lots on BDPL Nos. 1, 2, and 5, and the Tissiack/Crawford vaults on BDPL Nos. 3 and 4 support emergency earthquake recovery by enabling the system to be isolated on either side of the Hayward Fault.

Figure 4-4: Number of Valves Installed by Decade



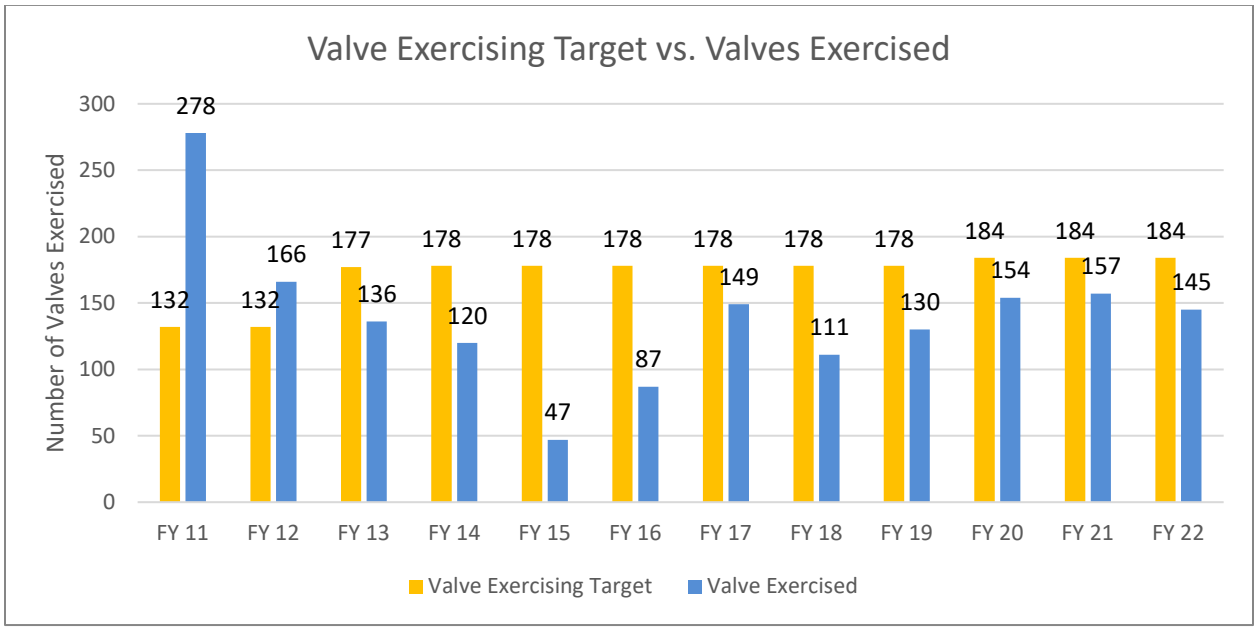
In the San Pedro Valve Lot, two valve vaults were seismically upgraded, electric valve operators were modified, a new air valve was installed, and miscellaneous site drainage improvements were made. Elsewhere under WSIP, a variety of valves (line and cross-over) were replaced/ added in SAPL Nos. 2 and 3.

The valve exercise program was enhanced in 2008 to extend the life of installed valves. It is designed to extend the useful life of valves, increase reliability, and reduce life-cycle costs. The program is based on specifications outlined in the valve manufacturers' O&M manuals, and on best management practices (BMPs). The O&M manuals and BMPs establish the level and frequency of maintenance required. Valves are primarily exercised by utility plumbers and occasionally by the machine shop crew and watershed keepers. The goals are to assess the condition of the valves, actuators, and appurtenances, and to determine operational capabilities and reliability.

The current valve exercise program is structured to be consistent with the American Water Works Association (AWWA) standards; all valves are exercised at least once every 2 years (line valves and cross-over valves). If full operation of the valve does not disrupt system operations, the valve is fully opened and closed in the exercise. If full operation of the valve is not possible due to operational constraints, the valve is "bumped," i.e., opened (or closed, if already open) at approximately 10 to 15 percent, then closed (or returned to fully open).

Prior to WSIP completion, there were 264 valves in the WSTD transmission system. With completion of BDPL No. 5, new BDPL Nos. 3 and 4 cross-over vaults, Alameda Siphon No. 4, SAPL No. 3 extension, Calaveras Dam, Alameda Creek Diversion Dam, and LCSD, the number has now increased to 368 valves (not including valves at the treatment plants). Figure 4-5 shows that the current target for WSTD is to exercise 184 valves every year, or all 368 valves every 2 years.

Figure 4-5: Number of Valves Exercised at Water Supply and Treatment Division from 2011 through 2022



The other valve exercise program component addresses valves housed in water treatment facilities that are exercised and maintained by the operations staff. Most valves in water treatment facilities are routinely operated as part of normal operations.

Cross- Connection Mitigation for Transmission Pipeline Appurtenances

The WQD is responsible for management and implementation of CCSF's cross-connection controls program, in compliance with all applicable regulations and standards. The California Waterworks Standards, including cross-connection prevention requirements for air valves and blow off valves, went into effect in 2008. The Waterworks Standards apply to new facilities and existing facilities requiring repairs (most SFPUC pipelines were built well before the Waterworks Standards, some as far back as the 1920s). Since the Waterworks Standards went into effect, SFPUC has been focused on WSIP implementation. As part of WSIP implementation and Waterworks Standard compliance, SFPUC developed standard drawings for appurtenances (e.g., air valves and blow-offs), referencing them in specifications in WSIP as well as CIP contract documents. With WSIP winding down, SFPUC proactively and voluntarily implemented the RCCCP to address pipeline appurtenances at older RWS facilities (i.e., facilities constructed prior to the adoption of the Waterworks Standards that were not part of WSIP).

RCCCP was initiated in 2016 as a collaborative effort between WQD and WSTD. The project sought to upgrade applicable appurtenances in RWS—air vacuum valves (AVVs), air release valves (ARVs), blowoff valves (BOs), and the vaults that house these appurtenances—to the latest standards, above and beyond regulatory requirements. The applicable regulations and standards are:

- California Code of Regulations (CCR), Title 17, Sanitation;
- CCR, Title 22, Waterworks Standards;
- AWWA Manual of Water Supply Practices M51;
- AWWA Standard C512; and
- WSTD Standard Drawings.

With the implementation of RCCCP, AVVs and ARVs in RWS will be installed with the vent opening above grade; above the calculated 100-year flood water level; readily accessible for maintenance; constructed and designed to prevent exposure to rainwater or runoff, vandalism, and birds, insects, rodents, or other animals; and fitted with a downward-facing screened vent or a domed and screened cap.

RWS has more than 250 miles of pipeline and tunnel that transmit potable water to wholesale customers and is fitted with more than 1,700 installed appurtenances of various sizes, types, functions, and periods of installation throughout the East Bay, South Bay, and Peninsula. The scope of the RCCCP includes:

- review of applicable regulations, and AWWA and SFPUC standards;
- development of checklists and templates for field assessment surveys;
- visual field assessments of all appurtenances and related vaults;
- identification of mitigation requirements and development of recommendations;
- grab field sampling of accumulated water in vaults, as needed;
- identification of inconsistencies in the current database of appurtenances and GIS;

- assessment reporting for each pipe segment; and
- implementation of mitigation measures for identified appurtenances, and revision of documents accordingly.

Due to the large number of appurtenances and pipelines in RWS, the pipelines were grouped and prioritized for field assessment starting with the longest pipeline segments to obtain representative data. Table 4-58 lists the tentative pipeline assessment and prioritization schedule, which is subject to refinement, depending on the number of appurtenances, assessment findings, future shutdowns, site accessibility, resources availability, mitigation progress, weather conditions, and any unforeseeable factors.

Table 4-58: Prioritization and Schedule for Cross-Connection Pipeline Assessment and Mitigation

Pipeline Segments	Field Assessment – Tentative Schedule	Mitigation – Tentative Schedule
BDPL Nos. 3 and 4	February 2016 through March 2017 (Completed)	May 2019 through October 2023
BDPL Nos. 1, 2, and 5	April 2017 through June 2018 (Completed)	June 2020 through October 2023
CSPL Nos. 2 and 3, and SSPL	July 2018 through September 2019 (Completed)	November 2023 through February 2025
Sunol Region and CSPL No. 1	October 2019 through December 2020 (Completed)	March 2025 through June 2025
SAPL Nos. 1, 2, and 3	March 2021 through December 2022	July 2025 through May 2026
Palo Alto Pipeline	January 2023 through April 2023	June 2026 through September 2026
CSSAPL	January 2021 through February 2021 (Completed)	October 2026 through December 2026

Notes:

BDPL = Bay Division Pipeline
CSSAPL = Crystal Springs-San Andreas Pipeline
CSPL = Crystal Springs Pipeline
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline

After assessments are completed, the project prioritizes mitigation recommendations using a risk-based approach. In general, appurtenances are deemed high risk when there is a relatively high probability of the water level reaching the valve opening inside the vault. Priority levels are described in the following paragraphs.

- **High Priority:** The AVV is below the riser's vent; the BO blind flange is not installed; or the BO does not have an air gap.

- **Medium Priority:** The AVV overflow rim is in the middle of the riser's vent; or the riser vent does not maintain a minimum of 6 inches of clearance above grade.

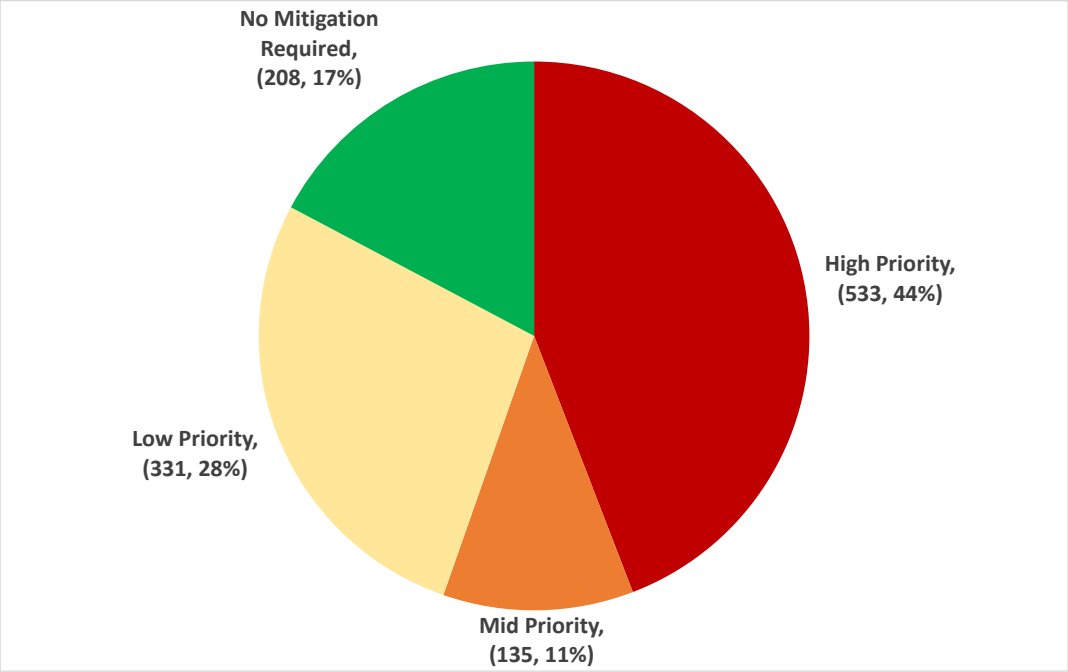
- **Low Priority:** The AVV overflow rim is above the riser's vent but missing items like bug screens; or the gate valve on the BO is not certified by NSF (formerly known as the National Sanitation Foundation).

- **None:** The appurtenance meets current standards.

The field assessment for BDPL Nos. 1, 2, 3, 4, and 5; CSPL Nos. 1, 2, and 3; SSPL; Sunol Region; and CSSAPL of RWS were completed up to the San Francisco County line, as shown in Table 4-58. The completed assessed pipelines are approximately 200 miles in total length, with 1,207 appurtenances. The project included completion of field assessments of 186 appurtenances for CSPL No. 1, Sunol Region, and CSSAPL in 2020 and 2021. Appurtenances are currently being assessed for SAPL Nos. 1, 2 and 3, a network of pipelines with more than 160 appurtenances, anticipated to be completed in 2022. The last set of pipelines for field assessment will be the Palo Alto Pipeline in the Peninsula, which is planned to be completed in 2023.

The assessment reports include appurtenance information; noncompliance findings; the Federal Emergency Management Agency's 100-year flood level, where applicable; and mitigation recommendations. The report also lists appurtenances that do not meet the current standards; that are vulnerable to flooding due to urban development; and that have been added, removed, or modified and do not match reference data from GIS and Maximo used by SFPUC.

Figure 4-6: Mitigation Priority Breakdowns for BDPL Nos. 1 through 5; CSPL Nos. 1, 2, and 3; SSL; Sunol Region; and CSSAPL



The site assessment surveys for BDPL Nos. 1, 2, 3, 4, and 5; CSPL Nos. 1, 2, and 3; SSPL; Sunol Region; and CSSAPL found that of the 1,207 appurtenances installed, 44 percent of the

appurtenances are high priority; 11 percent are medium priority; and 28 percent are low priority, not meeting current standards, given that most of the pipeline sections of BDPL Nos. 1 through 4 were constructed from 1933 to 1967.

Compared to the 2020 SRWS report, the revised field assessment schedule in Table 4-58 indicates about 12 months of delay as a result of finding approximately 100 more appurtenances during site surveys than the original estimated for CSPL No. 1, Sunol Region, and CSSAPL. In addition, the project team identified and assessed 14 additional appurtenances along the Sunset Supply/San Andreas branch transmission pipelines, which were not previously included in the appurtenances list for field assessment. Also, the COVID-19 pandemic, which began in 2020, caused close to a year of delay when nonessential field activities were suspended due to safety concerns.

WSTD started implementing mitigation measures for BDPL Nos. 1 through 5 in September 2017. Mitigation work normally requires significant preparation, including site visits to every appurtenance to measure and document required mitigation, such as raising existing vaults; installing and replacing vault covers; raising existing air valves; adding "goosenecks" to existing air valves; lowering surrounding grades; installing bug screens to air vents; sealing below-grade vents; removing all galvanized fittings and piping; and replacing corroded bolts, fittings, and non-NSF certified materials.

The mitigation work started slowly due to WSTD's resource constraints (e.g., plumbers and welders); other higher-priority maintenance work; new hiring and associated training; supply chain issues; and challenges related to the COVID-19 pandemic. In the last year and a half, WSTD has increased resource allocation to this project, resulting in a higher mitigation rate than prior years. As of December 2021, WSTD has completed 337 mitigations for the BDPLs. The revised mitigation schedule in Table 4-58 takes the most recent mitigation rate into consideration. Also, CSSAPL is moved to be the last pipeline segment for mitigation because it is a raw water forced main and not technically subject to cross-connection standards. Once the mitigation measures are implemented for the Palo Alto Pipeline, SFPUC will decide whether to proceed with mitigation for valves and vaults on CSSAPL.

The benefit of completing RCCCP goes beyond upgrading AVVs, ARVs, BOs, and vaults to the latest cross-connection standards. WSTD has leveraged this project to also repair damaged lids, add missing ladders, replace unsafe ladders, replace corroded fittings, and relocate appurtenances to more accessible locations away from traffic. As field assessments are conducted, valve riser and vault locations are updated in GIS and Maximo, effectively updating the asset registry for these assets.

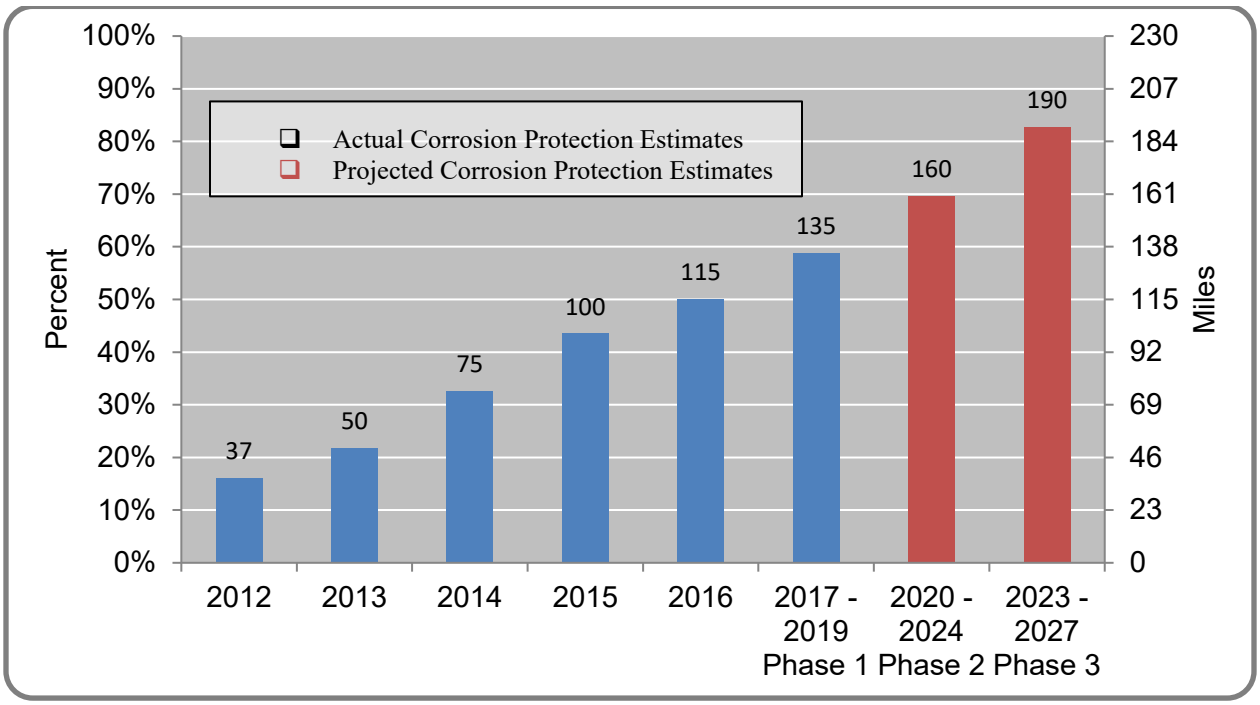
Corrosion Monitoring/Maintenance Program

The corrosion protection program is one of the cornerstones of SFPUC's asset management and PM efforts. Investments in the program are cost-effective, greatly extend the useful life of buried assets, and reduce unplanned outages. In FY10, SFPUC and Schiff Associates updated the corrosion master plan. The primary objectives of the effort were to update the state of the corrosion protection system for buried assets in the Bay Area.

Prioritized projects derived from the plan were then sequenced in the CIP over 8 years. The master plan first assessed transmission pipelines to determine the adequacy of corrosion protection of the existing system. Then the master plan made recommendations to repair

inadequacies and provide improvements for ideal corrosion protection. The cost of repairs and improvements was estimated to be between $18.3 and $22.1 million in 2010. WSTD started implementing the recommendations in FY11, and have completed repairs and improvements over the last 10 years. Projects that save the most money and protect the longest stretches of assets are implemented first. The scope of work is implemented over many years to reduce operational, construction, and staffing conflicts. Coordination efforts include acquiring service agreements from the power utilities, determining the ROWs, permit reviews from local City jurisdictions along the Peninsula and East Bay, and outreach to adjacent property owners. Figure 4-7 summarizes the progression over time of CP on WSTD transmission pipelines.

Figure 4-7: Cathodically Protected Transmission Pipeline[2]



The 2010 corrosion master plan identified corrosion potential and vulnerabilities from local ground conditions (e.g., corrosive soil or stray current) on 230 miles of transmission pipelines. With these field data, the study determined the adequacy of existing corrosion protection systems. Using those results, the study determined additional corrosion protection projects (including maintenance and monitoring work) that would most effectively and efficiently extend the remaining useful life of pipelines and buried assets.

In 2010, the condition assessment performed as a part of the master plan found that existing CP systems on the WSTD transmission lines were operating at less-than-adequate levels. Of the cathodically protected pipelines, only 15 percent of the linear length was adequately protected; the remaining 85 percent received only partial to no protection, leaving the pipeline subject to corrosion. Note that since the implementation of the 2010 corrosion master plan, CP of the transmission system has improved 5 to 10 percent annually.

[2] Does not include SJPLs.

Based on the analysis, many of the pipelines in the Peninsula and South Bay are subject to stray currents. This phenomenon is typically the result of direct current (DC)-powered light-rail transit systems, or one of the numerous other buried utilities applying CP in the vicinity of WSTD pipelines.

The report also indicated that the bulk of the pipeline alignments were installed in corrosive soils. The soil corrosivity is of concern due to the age of the infrastructure; specifically, that as pipeline coatings age they begin to deteriorate, exposing pipeline steel where corrosion is likely to occur. The more corrosive the soil, the higher the corrosion rate will likely be, resulting in exacerbated metal loss or loss of pipeline wall thickness.

Remediation of existing CP systems and conducting extensive studies at the areas identified in the report are relatively inexpensive when compared to construction costs of structures such as pipelines and pump stations. Projects were categorized by the type of corrosion protection (for example, electrical isolation) and by pipeline to bring the transmission system to an ideal protected state against corrosion.

Information is gained from planning efforts, such as results of internal pipeline inspections, liquefaction conditions, locations of earthquake fault zones, criticality of particular pipelines to the Bay Area delivery capacity, adopted LOS, and, to some extent, the adjacent land use and associated liabilities (i.e., public safety and claims) in the event of a pipeline leak or failure. This information is then used in conjunction with the results of the corrosion protection program to guide and prioritize maintenance, R&R, and capital planning.

Implementation of corrosion protection projects also requires knowledge of concurrent maintenance or capital projects, because implementation costs are significantly reduced when pipelines are taken out of service for more than one purpose. Similarly, many recommended corrosion protection projects become unnecessary if assets will be replaced under the current capital program, such as the submarine sections of BDPL Nos. 1 and 2.

SFPUC also performed an in-depth analysis of the major external corrosion-related issues for all the transmission pipelines identified in the updated corrosion master plan. Detailed recommendations, including preliminary plans and specifications, were provided for all necessary corrective actions.

Active corrosion protection program elements and recent accomplishments from FY21 are listed in the following sections, along with plans for FY22 and beyond.

New Rectifier CP System

Rectifiers are used to convert alternating current (AC) power to DC power for CP systems. The negative terminal of the rectifier is connected to the pipeline, and the positive terminal of the rectifier is connected to the anode bed. A rectifier consists of a circuit breaker, diodes, and a step-down transformer with various coarse and fine taps for voltage adjustment.

In addition to renovating the existing rectifiers, the in-depth analysis identified additional CP systems that would be needed to bring the corrosion protection level of the underground pipelines up to the protection criteria established by the National Association of Corrosion Engineers. The CP system consists primarily of the rectifier and deep anode. In FY15, SFPUC used

field survey information obtained from the in-depth analysis to put together a CP plan for installation of additional CP systems. Due to the many different locations identified for additional CP in the Peninsula and East Bay, the plan would be to prepare the construction bid packages in three separate phases by groups of pipelines. Table 4-59 describes the three phases and their corresponding scopes.

Table 4-59: Cathodic Protection for Water Supply and Treatment Division Transmission Pipelines at Various Locations

Phase #/Contract No.	Fiscal Year	Scope
Phase 1/Contract No. WD-2770	Design: FY15 – FY16 Construction: FY17 – FY19	Provide and improve the level of corrosion protection for the following pipelines: CSPL No. 1, CSPL No. 2, SAPL No. 1, and SAPL No. 2. The pipelines are along San Francisco, Daly City, South San Francisco, San Bruno, and Millbrae. During Phase 1, 10 new rectifiers and approximately 45 new test stations were installed.
Phase 2/Contract No. WD-2845	Planning/Design: FY19 – FY22 Construction: FY23 – FY24	Provide and improve the level of corrosion protection for the following pipelines: Palo Alto; and BDPL Nos. 1, 2, 3, and 4. The pipelines are along Stanford, Menlo Park, Palo Alto, Los Altos, Mountain View, Newark, and Fremont. During Phase 2, there will be 11 new rectifiers and approximately 200 new test stations installed.
Phase 3/Contract No. TBD	Planning/Design: FY23 – FY24 Construction: FY24 – FY27	Provide and improve the level of corrosion protection for the following pipelines: Alameda Siphon Nos. 1 and 2, Calaveras effluent and influent lines, SSPL, and SVWTP effluent line. The pipelines are along Sunol, Fremont, Hillsborough, Burlingame, Millbrae, South San Francisco, Colma, Daly City, and San Francisco. During Phase 3, there will be 20 new rectifiers and approximately 50 new test stations installed.

Notes:

BDPL = Bay Division Pipeline
CSPL = Crystal Springs Pipeline
FY = fiscal year
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline
SVWTP = Sunol Valley Water Treatment Plant
TBD = to be determined

The first phase provided 10 additional rectifiers with deep anodes to the transmission pipelines between San Francisco and Millbrae. The first phase also included installation of 45 additional test stations along the pipeline alignments; these stations were intended to accommodate the upcoming pipe-to-soil potential surveys (originally, 80 test stations were planned, but local agencies have been reluctant to issue permits along their ROWs). Fewer test stations translate to more time spent on performing corrosion surveys; nonetheless, due to the protection provided by rectifiers and anodes, the overall corrosion protection of the pipelines is not compromised. Construction for the first phase has been completed. The second and third phases will follow with an additional 33 rectifiers and deep anode columns, which will cover transmission pipelines in

the Peninsula and the East Bay. It is anticipated that 300 or more corrosion test stations will be installed as part of the second and third phases.

In FY21 and FY22, SFPUC staff continued to coordinate with Pacific Gas and Electric Company (PG&E) to study the power source locations, which resulted in the plans for 11 new rectifiers for the second contract. SFPUC staff is coordinating with local jurisdictions (Redwood City, Palo Alto, Stanford, Mountain View, Los Altos, Newark, and Fremont) to procure the permits needed to install the rectifier cabinets near the city sidewalks; anodes and test stations on city streets; and cable connections from the Phase 2 pipelines to the CP systems. SFPUC developed the design drawings and specifications for the bid package to construct 11 new rectifiers and 200 new test stations. For FY23 to FY24, SFPUC will coordinate with PG&E to study the power source for 20 new rectifiers, and to develop the design drawings and specifications for the third phase.

From FY16 to FY18, SFPUC performed a biennial survey to evaluate the existing state of the CP system and determine whether any remedial action was necessary for the corrosion control of the transmission pipelines. For FY22 to FY23, SFPUC will continue to perform the biennial survey to confirm that the CP system is still providing the expected protection level, and to continue making adjustments to the CP system as needed.

New Remote Monitoring Units to Monitor Rectifiers

The remote monitoring units (RMU) allow SFPUC to remotely monitor the entire CP rectifier system via the Internet. Alarm parameters can be set to notify staff via email or text message in case of loss of AC power, out-of-range pipe-to-soil potentials, out-of-range current output, etc. Once the notification is received, staff will be able to remedy issues at each rectifier. Without the RMUs, staff would need to physically visit each site to manually read this information. SFPUC installed 10 more RMUs in FY18-FY19 to monitor the new rectifiers installed in the first contract. There are 56 existing RMUs that monitor the existing rectifiers currently providing CP for the transmission pipelines. In FY21 and FY22, SFPUC continued to perform routine maintenance on the RMUs, most notably upgrading the cellular communications modules on each unit to the 4G service and replacing some units with newer antennas. The routine maintenance with RMUs is being addressed by corrosion consultants. In general, RMUs have performed in accordance with the design.

CP Test Stations

CP test stations are essential for providing an easily accessible above-ground direct connection point to the pipelines for corrosion surveys. The test station typically consists of two wires, bonded to the pipeline underground and terminating on a test board either in a box flush to grade or on a post. It is important for survey efficiency to have the test stations at regular intervals along the pipeline alignment. SFPUC installed 45 new test stations in the first contract in FY18. About 200 new test stations are planned to be installed during the second contract in FY23 and FY24.

Pipeline Isolation/Continuity

Pipeline isolation and pipeline continuity are critical elements to establish the limited boundaries of CP. To effectively achieve the adequate levels of CP, protected pipeline segments must have continuity (through welded joints or bonding cables) from one piece of pipe (generally 40 feet long) to the next. The ends of the protected segment must be isolated using insulating flange kits. When these elements are not properly installed or when they fail, repairs (mostly through

repairing the insulated flange joint) must be done before CP can be applied effectively. In rare instances, replacement of a gasket is needed, which requires dewatering the pipeline. The continued biennial corrosion surveys will identify whether additional points of pipeline isolation will need to be added or restored.

Corrosion Surveys

The pipe-to-soil potential survey for each transmission pipeline will be performed every 2 years and will indicate whether the level of CP is adequate. The survey will also reveal whether field conditions have changed from the previous survey or whether CP interference is occurring in the field. The rectifiers are normally adjusted by changing the coarse and fine taps of the step-down transformer during the pipe-to-soil potential survey, to compensate for changes in the field conditions. After getting the existing CP systems back to an adequate corrosion protection level through the first three contracts, continued biennial corrosion surveys will be performed to determine how the system is working and what additional CP upgrades or repairs are needed.

Meter Improvement Program

RWS relies on numerous flow meters to manage day-to-day operations. Meter data are used for system hydraulics analysis, tracking daily and longer-term water use, and computing system water balances. Meter data are also used for financial purposes to support the computations for wholesale and retail water use, which directly affects cost allocations between these customer classes. The objective of the meter improvement program is to comply with contractual requirements, increase meter accuracy, increase reliability (reduce data dropouts), standardize installations, and lower maintenance costs by reducing emergency call-out repairs.

The meter improvement program implements calibration and maintenance requirements outlined in Appendix J of the 2018 WSA. The program focuses on more than 40 meters. For the FY21 and FY22 period, 98 calibrations were performed. RWS meters are generally organized into four categories: system input/output meters, in-line meters, county-line meters, and terminal storage meters. These meters are discussed in significant detail, including their inventory, required maintenance, and calibration, in the 2018 WSA. All the meters are regularly calibrated through an independent metering consultant.

The San Francisco/San Mateo county-line meters are a priority of the program due to their role in wholesale revenue requirement cost allocation. Table 4-60 lists the FY21 and FY22 calibration summary of the county-line meters. The program ensures regularly scheduled calibrations and as a result has returned more consistent and reliable readings. During the 2-year period covered in this report (FY21 and FY22), all meters were found to be within the ±2 percent requirement of the 2018 WSA. By practice, whether or not a meter is found to exceed the calibration criteria, the independent meter consultant inspects the components, flushes lines, and conducts a repeat test on the same day. Maintenance of the meters includes regular cleaning and replacement of parts, as determined by the meter calibration consultant.

Each year, meter installations are evaluated for upgrades and improvement as part of the calibration routine. County-line meters are a priority, due to their role in wholesale revenue requirement cost allocation; consistent quarterly calibrations and maintenance ensure that meter equipment is upgraded as needed, thereby reducing the frequency of meter failure or poor performance. A summary of equipment replacement in FY21 and FY22 is presented in Table 4-61.

Table 4-60: FY21 and FY22 County Line Calibration Summary

Fiscal Year		Date	Crystal Springs No. 1	Crystal Springs No. 2	San Andreas No. 2	San Andreas No. 3 **	Sunset Supply (LMPS)	Sutro Pipeline (LMPS)	Total Per Quarter
FY-21	1st Quarter	July 2020							6
		August 2020							
		September 2020	✓	✓	✓	✓	✓	✓	
	2nd Quarter	October 2020		--					6
		November 2020	✓	--	✓				
		December 2020		--	✓	✓	✓	✓	
	3rd Quarter	January 2021	--	✓	--			--	4
		February 2021	--		--			--	
		March 2021	--	✓	--	✓	✓	--	
	4th Quarter	April 2021	✓	--	✓			✓	8
		May 2021	✓	--				✓	
		June 2021		--	✓	✓	✓		
FY-22	1st Quarter	July 2020	--	✓	--	--	--	--	1
		August 2020	--	--	--	--	--	--	
		September 2020	--	--	--	--	--	--	
	2nd Quarter	October 2020	✓	✓	✓	✓	✓	✓	12
		November 2020			✓	✓	✓		
		December 2020	✓	✓				✓	
	3rd Quarter	January 2021							6
		February 2021							
		March 2021	✓	✓	✓	✓	✓	✓	
	4th Quarter	April 2021							6
		May 2021	✓	✓	✓		✓	✓	
		June 2021				✓			
Total Calibrations For FY21 and FY20			8	8	9	8	8	8	49

Notes:

✓ = Calibrated
-- = Performed Next Quarter
FY = fiscal year
LMPS = Lake Merced Pump Station

Table 4-61: Summary of Meter Equipment Replacement, Installation, and Improvement

FY	Meter	D/P Transmitter and Related Plumbing	Data Logger	Pitot Tap	New Meter	Improve Meter Loop Wiring	Improve Instrument and SCADA Installation
FY22	Crystal Springs No. 2					✓	
	LMPS Outfall Meter	✓					
	HTWTP Effluent	✓					
	Pulgas Valve Lot Meter	✓					

Notes:

D/P = differential pressure
FY = fiscal year
HTWTP = Harry Tracy Water Treatment Plant
LMPS = Lake Merced Pump Station
SCADA = supervisory control and data acquisition

Regional Water System Water Balance Computation

Reliable and accurate meters are necessary to support customer billing and computation of the wholesale revenue requirement. Additional meters are used to compute the system water balance. The annually measured inflow into the water system has been within 1.7 percent and 2.3 percent of the outflow (outflow defined as sales to customers, including San Francisco) for FY20 and FY21, respectively. Results from FY22 are pending. These results suggest that overall system losses are likely small. As a comparison, water losses reported by retail water systems in California averaged 9 percent for calendar year 2020.

As discussed in prior reports, the accurate measurement of spillage into Crystal Springs Reservoir is thought to be a primary point of measure for ensuring a positive water balance where input exceeds output. Over the last 6 years, consistent measurement of spillage into Crystal Springs has not completely eliminated the occurrence of output exceeding input; however, the frequency of such occurrences has decreased when compared with years past. For example, output exceeded input once in the past 6 years (FY16 to FY21) compared to four times in the prior 6 years (FY10 to FY15). In reality, system losses are certainly nonzero, and inflow into the system in some years may be less than out outflow; such occurrences may suggest some level of meter error in the calculation. Ongoing tracking of input versus output is an important means to gain insight into system meter performance.

Automated Meter Infrastructure

Advanced meter infrastructure (AMI) meters have been in wide use at wholesale service connections for more than 5 years. A small percentage of the wholesale service meters are not outfitted with AMI for reasons of either meter incompatibility or poor cellular service due to remote meter location. SFPUC's regional AMI relies on cellular signal for data transmission.

AMI technology enables more immediate evaluation of usage and water balance analysis. AMI data, in combinations with ongoing meter calibrations and maintenance, ensures that potential

sources of data errors are found early on during a data dropout occurrence. Together, analyses of AMI and system meter data lessen the occurrence of potential errors and result in timely corrective actions, as needed.

The AMI program allows customers to log in to a protected webpage to view their own water usage and track water deliveries from SFPUC in near real time. In late 2017, SFPUC retired the use of manual log books for recording wholesale customer billing meter reads and began using AMI-generated meter read reports for billing purposes. Meter reads by manual field observation remains a viable option for obtaining as-needed meter reads.

Late in FY22, the AMI service was interrupted due to changes in the cellular industry related to the move to 5G service. In response, SFPUC purchased new 5G-compatible AMI transponders. The existing non-5G transponders are being replaced. and this work is scheduled to be completed in fall 2022.

FY23 and FY24 Planned Work

In addition to replacing aging equipment, future projects include:

- installing new pitot taps at Irvington Meters 1 and 2;
- improving instrumentation layout to prevent inundation at Calaveras Meter;
- completing new AMI transponder installations;
- assessing SA2 meter instrument cabinets for replacement;
- access improvements to the Sunset pitot taps;
- installing a new Venturi meter for the Alameda Creek Recapture Project;
- new meter installation from Pulgas Channel outfall to UCSR; and
- replacing two of the City of Hayward's 16-inch turbine meters with 12-inch ultrasonic meters.

4.3.2.2 Asset Descriptions, Maintenance, and Condition

WSTD is responsible for the maintenance and operation of multiple water transmission assets that work as a system to transport water from the AEP to the county line of San Francisco. These assets include:

Alameda East Portal
Alameda Siphons
Calaveras Pipeline
San Antonio Pump Station
San Antonio Pipeline and San Antonio Backup Pipeline
Pond F3 East
Alameda West Portal
Irvington Tunnel Nos. 1 and 2
Irvington Portal
Bay Division Pipeline Nos. 1, 2, and 5
Bay Division Pipeline Nos. 3 and 4
Intertie Pump Stations (East Bay Municipal Utility District and Valley Water)
Bay Tunnel
Stanford Tunnel
Pulgas Valve Lot
Pulgas Tunnel
Pulgas Pump Station
Pulgas Balancing Reservoir
Crystal Springs Bypass Tunnel and Pipeline
Crystal Springs Pump Station
Crystal Springs Pipelines Nos. 1, 2, and 3
Sunset Supply Pipeline
Hillsborough Tunnel
San Andreas Pipelines Nos. 2 and 3
Capuchino Valve Lot
Baden Pump Station
Baden Valve Lot
San Pedro Valve Lot

SFPUC regularly performs internal pipeline inspections as part of maintenance to proactively find potential vulnerabilities in transmission pipelines before major problems occur. A combination of acoustic sounding (with ball peen hammer) and visual inspections is performed for all pipelines. For PCCP, an additional electromagnetic test is performed by a specialized contractor to determine the number of broken prestressed wires. These methods have been used throughout the industry for more than 10 years and are considered tried-and-true methods.

There are a variety of pipeline types and sizes that require specific inspection techniques to detect defects and assess conditions particular to each pipeline. Each type of defect requires unique repair methods to restore the pipeline. Some defects are significant enough, or extensive enough, to warrant replacement or slip-lining.

Most inspections of pipelines use visual methods to detect defects. The most common category of pipeline is WSP, representing more than half of the total length of transmission pipelines. Riveted pipe, the oldest in the transmission system, also makes up a significant portion of the transmission pipelines. RCP is also inspected visually. It is a rigid pipe but has flexible joints, a unique feature. Steel "lockbar" pipeline develops defects similar to those of WSP. Both RCP and lockbar pipe make up a small portion of the transmission pipelines. A combination of sounding (with a ball peen hammer) and visual inspections is performed for all pipelines. For a pipeline that has access difficulties and/or is not feasible for shutdown, acoustic leak detection inspection has been used in the past while the pipeline is in service.

WSTD performs electromagnetic inspections and visual inspections for PCCP. There are 22 miles of PCCP in RWS still in operation. PCCP modes of failure usually have catastrophic consequences. The concrete cylinder could rupture without warning when there is loss of prestress wiring. Electromagnetic inspections estimate the number of prestress wire breaks (when intact, these wires provide most of the hoop strength).

Potentially explosive gas is present in many SFPUC tunnels and there are long stretches of tunnel without intermediate access. The care that must be taken to ensure safety under these conditions, including safe pipe isolation practices for confined space entry, make tunnel inspections particularly difficult.

WSTD has created a schedule for inspecting approximately 250 miles of pipeline. This schedule was created using a multi-step process based on a pipeline's likelihood to fail, and the COF. This process emphasized public safety by prioritizing inspections for pipelines that have the highest chance of catastrophic failure and are near the public.

As pipelines are taken out of service for construction and O&M activities, associated pipeline appurtenances must be operable to accommodate isolation, dewatering, and disinfection activities. Consequently, all related appurtenance valves, vaults, and drainage paths, and some line valves, are serviced on affected pipelines as required.

After pipelines have been inspected, the pipeline condition information from the inspection will be used to help make an informed decision when prioritizing capital improvements projects for each pipeline segment.

Pipeline inspections that require entry in a dewatered pipeline were halted during the COVID-19 pandemic due to the poor ventilation in confined spaces. Pipeline maintenance inspections will resume in FY23.

Alameda East Portal

Description. AEP west of the CRT is in the hillside to the east of Calaveras Road. The Calaveras Fault Zone lies several hundred feet west of this location. The portal includes a 10.5-foot-diameter steel pipe with four pipe connections that distribute water to the four Alameda Siphons. Additionally, the portal overflow shaft includes a catchment basin and an emergency overflow pipeline discharging to an adjacent quarry pit.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. AEP is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Alameda Siphons

Description. The Alameda Siphons include four pipelines (AS-1 through AS-4) that stretch approximately 3,000 feet across the Sunol Valley, from the AEP to the AWP. The siphons were constructed from various materials between 1934 and 2011. All four pipelines cross the Calaveras Fault and Alameda Creek. Portions of AS-1 through AS-3 in the fault zone are susceptible to failing due to ground surface rupture. WSIP evaluated alternatives to bring AS-1 through AS-3 up to the latest seismic standards versus building a new siphon; construction of a new siphon was determined to be the best alternative. AS-4, added under WSIP in 2011, has been designed with special provisions to allow it to withstand these seismic forces.

Water flowing through the siphons originates from Hetch Hetchy and/or the SVWTP. The characteristics of the two sources, primarily hardness and alkalinity, vary significantly. The siphons therefore include the mixing manifold, which is designed to blend the water from the two sources and to mix SVCF chemicals to provide water of uniform characteristics downstream.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Alameda Siphons (AS-1 through AS-3) are in fair condition. AS-1 and AS-3 are expected to fail following a Magnitude 6.8 earthquake on the Calaveras Fault. AS-2 may survive the design earthquake, but will likely suffer ovalization. AS-4, the newest Alameda Siphon, built to withstand a M6.8 earthquake on the Calaveras Fault, is in good condition. Air Gap Nos. 1 and 3, which connect AS-3 with SAPL and SABPL, have shown signs of upward movement. WSTD surveyors are regularly monitoring the movement. The Alameda Siphons are fit for service; however, the facilities may require capital investment to address pipeline movements at the air gaps at some point.

Calaveras Pipeline

Description. The Calaveras Pipeline extends approximately 6 miles from the outlet tower of Calaveras Reservoir northward to the SAPS. The pipeline was initially constructed in 1965, with major upgrades in 1992. This WSP pipeline ranges in diameter from 44 to 78 inches. Portions of

the pipeline at Calaveras Dam was replaced as part of WSIP. The pipeline has four functions, which include:

- conveying water from Calaveras Reservoir to the SVWTP;
- conveying water from Calaveras Reservoir to the Calaveras Creek discharge point;
- conveying water from Calaveras Reservoir to San Antonio Reservoir by gravity; and
- conveying water from either San Antonio Reservoir or Hetch Hetchy to SVWTP.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Calaveras Pipeline is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

San Antonio Pump Station

Description. SAPS was constructed in 1968 and subsequently modified in 1992 and 2011. The latest modifications under WSIP included the replacement of three of the 1,000-horsepower electrical pump casings, the addition of two 1.5 MW emergency generators, and the seismic retrofit of the building for life safety. In 2015, the Water CIP funded further upgrades at SAPS by replacing one of three diesel-driven motors with an electrically driven one, along with related upgrades. SAPS is integral to the operation of the facilities in the Sunol Valley and operates to transfer water between the various facilities, including the Alameda Siphons, San Antonio Reservoir, and SVWTP.

Maintenance. During this reporting cycle, control panel upgrades were completed on the diesel fuel day tank system to strengthen safety measures and prevent diesel fuel spills. Circuit breaker testing and repair were also completed. There is also a future project in design to replace components of the switchgear and MCC, improve the HVAC system, perform a seismic retrofit of the control room, and install a new 150-kilowatt propane standby generator. Smaller future R&R projects include inspection and, if necessary, internal recoating of the pump casings for the electric SAPS pumps; and providing a monitoring system for the permissive devices to facilitate pump alarm troubleshooting for the SAPS electric pumps.

Future projects under consideration include conversion of the remaining two diesel-driven pumps to electric pumps. Significant capital improvements even beyond what is scoped in the CIP will need to be considered for the Sunol Valley, due to the need for a pump station at that location, and due to the age of the current pump station (built in the 1960s). A new pump station inevitably needs additional power; coupled with the SVWTP ozone project, this may lead to upgrades to the Calaveras Substation and power modifications from HHWP, which currently powers the entire Sunol Valley. Furthermore, performance requirements would need to be revisited with two criteria in mind: (1) Calaveras Reservoir as a water source and (2) Hetch Hetchy aqueduct reliability to the Sunol Valley. A needs assessment will be initiated along with initial planning discussions. The most obvious considerations would be replacing the diesel pumps, overhauling the electrical system, and possibly relocating the pump station off the Calaveras Fault. Those items would be evaluated in context.

Condition. SAPS is in good condition and fit for service.

San Antonio Pipeline and San Antonio Backup Pipeline

Description. The San Antonio Pipeline was constructed in 1967 to connect San Antonio Reservoir to SAPS and the Hetch Hetchy transmission system at the Alameda Siphons. The SABPL was constructed in 2013 under WSIP. SAPL extends from the Alameda Siphons and SAPS to the outlet structure in San Antonio Reservoir. SABPL extends from the Alameda Siphons to the surface mining permit (SMP) 24 Quarry Pond, also referred to as Pond F3 East.

SAPL and SABPL serve several very important purposes, including:

- transferring water from the CRT for storage or discharge;
- transferring water from Calaveras Reservoir to San Antonio Reservoir to optimize storage in the two East Bay reservoirs;
- transferring water from San Antonio Reservoir to SVWTP, either by gravity or via pumping at SAPS, depending on system hydraulics;
- recapturing water discharged to Pond F3 East by transferring to San Antonio Reservoir; and
- releasing water from the reservoir to San Antonio Creek.

SABPL provides SFPUC with greater flexibility in managing water quality while maintaining supply to customers through SVWTP. This function allows SFPUC to meet WSIP LOS goals and objectives during an unplanned outage of the Hetch Hetchy water supply.

Maintenance. Leak detection inspections were performed for SAPL and SABPL in August 2021. The inspections were carried out using Pure Technologies' Sahara acoustic leak detection tool for the 60-inch SAPL and the 66-inch SABPL. No leaks were found. Pipe joints were inspected via closed-circuit television and were found to be normal in appearance for the majority of the sections inspected.

Condition. SAPL and SABPL are in fair condition; however, ground fissures, 800 feet in length, had developed between the pipelines and an active mining quarry (SMP 30) operated by Oliver De Silva in the Sunol Valley. The ground fissures can lead to landslide and subsequently undermine SAPL and SABPL. To determine the cause of the ground fissures and support the geotechnical investigation, leak detection inspections were performed for both pipelines. SAPL and SABPL are fit for service; however, the facilities require capital investment to address geologic hazards through the Pipeline Inspection and Repair R&R Project.

Pond F3 East

Description. Pond F3 East is a facility that provides supplemental storage to discharge, recapture, and/or treat Hetch Hetchy water that does not meet primary and/or secondary drinking water standards. Under normal operation, Pond F3 East is used when the CRT has been out of service for an extended period (e.g., Hetch Hetchy shutdown) and needs to be flushed prior to returning Hetch Hetchy supply into RWS. Water captured in Pond F3 East is then pumped into San Antonio Reservoir or directly to SVWTP, where it can be treated for future use. The operating level of Pond F3 East is 195 to 240 feet and has a storage capacity of approximately 150 million gallons in this elevation range. The current pumping system was not designed to pump lower than 195 feet; however, contractor support has been used in the past to pump below this elevation to create additional storage capacity based on operational needs and projections.

Maintenance. In September 2020, construction started on a project to install staff gages on the Pond F3 East spillway to provide a visual indication of the pond's water elevation; replace handrails to improve employee safety at the site; and replace one of two submersible pumps that had failed. Additional work was performed to modify the pipe casing to prevent the new sled-mounted submersible pump and discharge hose from rotating while in operation. With the completion of the recent construction work, Pond F3 East will continue to operate in its current form, allowing for noncompliant water and water flushed from CRT after HHWP shutdowns to be recovered. The current operating protocol is to use one of the two submersible pumps to transfer water from Pond F3 East to San Antonio Reservoir.

Condition. Pond F3 East is in good condition. The performance and reliability of both pumps will be assessed; in the future, the remaining older submersible pump may be replaced to ensure adequate pumping redundancy.

Alameda West Portal

Description. AWP is on the western hillside of Calaveras Road. The Calaveras Fault Zone lies east of this location. The portal is where all four Alameda Siphons converge into Irvington Tunnel Nos. 1 and 2.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. AWP is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Irvington Tunnels Nos. 1 and 2

Description. There are two Irvington Tunnels; the original Irvington Tunnel No. 1 was constructed in 1934 and Irvington Tunnel No. 2 was completed in 2014 as part of WSIP. All of the water from Hetch Hetchy and SVWTP flows westward through these two tunnels, from the Sunol Valley to the BDPLs.

Irvington Tunnel No. 1 is 18,193 feet long and has a 10.5-foot inside diameter. The tunnel is completely lined with either concrete or gunite.

Irvington Tunnel No. 2 is slightly longer, with a length of 18,300 feet. This tunnel was excavated in a shape resembling a horseshoe, and finished with an 8.5-foot-diameter WSP with cement mortar lining (CML).

Although Irvington Tunnel No. 2 was built as a redundancy to Irvington Tunnel No. 1, both tunnels are typically in service under normal operations.

Maintenance. Irvington Tunnel No. 2 was inspected in 2020, using an ASI Marine Falcon remotely operated vehicle (ROV). Visual and sonar data were collected as the tunnel was inspected from the AWP to the Irvington Portal. Review of the tunnel profiles generated from the collected sonar data did not reveal any anomalies in the tunnel other than the sediment that was observed visually. Tunnels are inspected every 20 years.

Condition. Irvington Tunnel No. 1 and Irvington Tunnel No. 2 are in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Irvington Portal

Description. Water from Hetch Hetchy and SVWTP is conveyed from the Sunol Region to the BDPLs through the parallel Irvington Tunnels Nos. 1 and 2. The Irvington Portals provide the ability to isolate each tunnel on its downstream end, distribute water to the five BDPLs, and isolate each pipeline on its upstream end. SFPUC maintains a number of key water quality compliance points, including one at the Irvington Portals. RWS pH compliance is determined at the Irvington Portals. Other water quality parameters monitored at the Irvington Portals include pH, fluoride, free ammonia, total chlorine, and turbidity.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Irvington Portal is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Bay Division Pipeline Nos. 1, 2, and 5

Description. BDPL Nos. 1, 2, and 5 are aligned in a relatively direct line westward from the Irvington Portals in Fremont to the Pulgas Valve Lot in Redwood City, a distance of approximately 21.5 miles. BDPL No. 1 was constructed in 1925; BDPL No. 2 in 1935/1936; and BDPL No. 5 in 2016 as part of WSIP, together with the new Bay Tunnel. With the new Bay Tunnel transmitting the combined flow from the three pipelines, the old BDPL Nos. 1 and 2 crossing the Bay have been decommissioned.

BDPL Nos. 1, 2, and 5 cross the Hayward Fault and therefore are especially susceptible to major seismic events on that fault.

The East Bay reach is approximately 37,600 feet (7.1 miles) in length. Seismically resistant crossings of the fault were constructed under WSIP. The initial (easternmost) 6,800 feet of BDPL No. 1 is constructed of 57-inch steel cylinder concrete pipe. The remainder is constructed of 60-inch riveted steel pipe. The first 6,800 feet of BDPL No. 2 is constructed of 62-inch steel cylinder concrete pipe and the remainder with 66-inch wrought steel pipe. BDPL No. 5 is constructed of 72-inch WSP.

The Peninsula reach is approximately 47,900 feet (9.06 miles) in length. BDPL No. 1 is constructed of 60-inch riveted steel pipe. BDPL No. 2 is constructed of a combination of 66-inch wrought steel pipe and 62-inch steel cylinder concrete pipe. BDPL No. 5 is constructed of 60-inch WSP.

Maintenance. A capital project was initiated to repair lining defects that were identified from previous inspections along BDPL Nos. 1, 2, 3, and 4, and to repair lining defects expected to be identified in future inspections. When this contract is in place, maintenance inspections and lining repairs can be performed within the same shutdown, eliminating the need for a second shutdown to perform repairs.

The scope of work primarily consists of removing corrosion accumulated at pipe joints from spalled CML, applying new cement mortar or dielectric lining, and cleaning debris and sediment found inside the pipe. During this reporting cycle, the Conceptual Engineering Report was finalized, and the project entered the design phase.

Condition. BDPL Nos. 1, 2, and 5 are in good condition and fit for service; however, BDPL Nos. 1 and 2 require capital investment to address maintenance lining defects through the As-Needed Pipeline Repair Project, as described in Section 4.3.2.3 of the CIP.

Bay Division Pipeline Nos. 3 and 4

Description. BDPL Nos. 3 and 4 proceed southward from the Irvington Portals, circling around the southern end of San Francisco Bay, through the northern part of San Jose and Santa Clara, and then northward to the Pulgas Valve Lot in Redwood City. This alignment differs significantly from that of BDPL Nos. 1, 2, and 5, providing increased reliability and the ability to efficiently serve the numerous wholesale customer turnouts. Each pipe line consists of approximately 33.9 miles in length. BDPL No. 3 was constructed in 1952, and BDPL No. 4 was constructed in 1967.

BDPL Nos. 3 and 4 also cross the Hayward Fault and therefore can be particularly impacted by major seismic events on that fault. The diameters of the pipelines range from 72 to 96 inches, and the pipelines materials include steel-RCP, PCCP, and WSP. Before WSIP, the distance between crossover points on these two pipelines spanned approximately 8 miles. This large distance made it difficult to take segments of pipe out of service for planned inspections and maintenance. The BDPL Nos. 3 and 4 Crossovers Project added three additional isolation/crossover facilities, so that the distance between crossover points is approximately 4 miles. This makes the system easier to maintain and repair, and increases the number of customers that would likely receive water within 24 hours following a major seismic event. The three crossover facilities constructed under WSIP are near the Guadalupe River, Barron Creek, and Bear Gulch.

BDPL Nos. 3 and 4 cross the Hayward Fault near the intersection of Mission Boulevard and Interstate 680 (I-680). The maximum credible seismic event would have resulted in probable failure of both pipelines. For BDPL No. 3, a new 300-foot-long concrete vault with articulating sections was constructed under Mission Boulevard. The vault houses a section of 72-inch WSP, with ball joints and slip joints that can accommodate pipeline displacement during a seismic event. BDPL No. 4 is designed to fail in a controlled manner that does not cause failure to BDPL No. 3. The seismic upgrade of BDPL Nos. 3 and 4 provides a seismically reliable conduit crossing the Hayward Fault.

BDPL Nos. 3 and 4 converge into the Stanford Tunnel. This tunnel is 810 feet long and 90 inches in diameter and is constructed of cement-lined and coated-steel pipe.

Maintenance. In response to Union Pacific Railroad's plan to add a second track over BDPL Nos. 3 and 4 in Santa Clara, a R&R project was initiated to address pipe protection from loading of the second track system. The scope of work includes sliplining of 75 feet across the railroad's ROW, adding new manholes to improve access, and making improvements to the appurtenances to meet current water quality standards. This project will begin construction in spring of 2023.

The PCCP segment of BDPL No. 4, between valves D60 and D70, had developed several leaks at the mid-Peninsula region. In 2017, an inspection found numerous circumferential cracks in the last 1.5 miles that parallel Edgewood Road in Redwood City. These cracks were mostly small, with only a few as wide as 0.125 inch. Although the circumferential cracks are not currently posing a structural risk, leaks have developed over time due to corrosion of the inner steel cylinder. This is believed to be a result of the circumferential cracks. In August 2020, an external

condition assessment was performed for certain pipe segments to verify the number of broken prestressed wire wraps found in the 2017 inspection. That same assessment was performed to verify the accuracy of the electromagnetic method of determining wire breaks, with positive confirmation of accurate results.

In March 2021, BDPL No. 4 was shut down to repair leaks caused by the circumferential cracks. WEKO-seals were installed to seal the leaks. Condition assessment findings and leaks confirmed that both the broken prestressed wires and circumferential cracks need to be addressed. In September 2021, another leak was found in the same stretch, immediately downstream of a previously repaired leak. Suspecting that new leaks may have been developing as the pipeline went through wet and dry cycles, staff decided against another pipeline shutdown. Staff implemented BMPs by diverting the leak to a nearby storm drain. It was noted that since its initial discovery, the leak has remained low and stable. The leak is being dechlorinated and monitored.

Condition. BDPL Nos. 3 and 4 are in fair condition. However, the PCCP a more comprehensive study of the segment between Valve D60 and D70 will needed to analyze the cause of failure and determine a methodology for mitigation. A capital project is currently underway that will investigate the root cause of the leaks and determine next steps.

BDPL Nos. 3 and 4 are fit for service. However, the PCCP segment requires active monitoring and capital investment to address both the broken prestressed wires and the circumferential cracks through the BDPL No. 4 PCCP Repair Project, as described in Section 4.3.2.3.

Intertie Pump Stations (East Bay Municipal Utility District and Valley Water)

Description. SFPUC co-owns an intertie in Hayward with East Bay Municipal Utility District (EBMUD). The facility is operated by the City of Hayward in accordance with a Joint Exercise of Powers Agreement between SFPUC, City of Hayward, and EBMUD. SFPUC also co-owns an intertie with Valley Water in Milpitas. Each intertie offers the principal parties access to other regional water suppliers in emergencies or during planned maintenance of a critical facility. The EBMUD-SFPUC intertie was completed in 2007, and the SFPUC-Valley Water intertie was completed in 2000.

Maintenance. The City of Hayward is the designated lead for O&M at the EBMUD-SFPUC intertie. SFPUC has had the lead maintenance role for the SFPUC-Valley Water intertie from 2000 to 2009 and as of January 2014. This role was passed on to Valley Water for 5 years while WSIP was under construction. SFPUC is in discussion with Valley Water regarding Valley Water becoming the designated lead for O&M at the SFPUC-Valley Water intertie. This change will require an amendment to the existing O&M agreement.

Condition. The EBMUD-SFPUC and SFPUC-Valley Water intertie pump stations are in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Bay Tunnel

Description. The Bay Tunnel was completed in 2014 as part of WSIP, to replace BDPL Nos. 1 and 2 and to transmit water across San Francisco Bay. The Bay Tunnel has a 9-foot-finished-diameter WSP with cement mortar lining. The tunnel is approximately 26,200 feet (4.96 miles) in length.

The tunnel, which is 70 to 110 feet below sea level, extends from Newark Valve Lot and Tunnel Portal to the Ravenswood Valve Lot and Tunnel Portal.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Bay Tunnel is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Stanford Tunnel

Description. BDPL Nos. 3 and 4 converge at Stanford Tunnel Valve House East, travel for the 810-foot length of Stanford Tunnel, and diverge and continue on again as separate pipelines at Stanford Tunnel Valve House West. Stanford Tunnel was constructed in 1952. It is approximately 810 feet long and 7.5 feet in diameter. The entire length of the tunnel is lined with steel pipe.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Stanford Tunnel is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Pulgas Valve Lot

Description. The Pulgas Valve Lot, near the intersection of Edgewood and Crestview Roads in Redwood City, is the western terminus of the BDPLs. The purposes of this facility are to combine the flows from the five pipelines just upstream of the Pulgas Tunnel, maintain pressure in the upstream reach of pipe, provide isolation for the upstream reaches of pipe, and measure and totalize the flow rate for reporting purposes.

Maintenance. No PM was required or completed during this reporting cycle. Some upcoming minor improvements at the Pulgas Valve Lot include a project to provide standby generator running status signals and position of the automatic transfer switch to SCADA.

Condition. Pulgas Valve Lot is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Pulgas Tunnel

Description. The Pulgas Tunnel was constructed in 1924. Its original purpose was to transmit water from the BDPLs at the Pulgas Valve Lot to the Peninsula reservoirs. In 1969, the Crystal Springs Bypass System was constructed to enable water from the Pulgas Tunnel to be diverted northward directly to the low-pressure zone pipelines on the northern portion of the Peninsula. The Pulgas Overflow Channel is the release point for excess water in RWS, discharging water from the tunnel to UCSR. It is also the first "daylight" point for Hetch Hetchy water downstream of the Moccasin Reservoir.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Pulgas Tunnel is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Pulgas Pump Station

Description. The Pulgas Pump Station and Balancing Reservoir were constructed in 1975. The facilities function to dampen pressure fluctuations and maintain the hydraulic gradeline in the upstream Pulgas Tunnel and Crystal Springs Bypass Tunnel. The pump station wetwell also serves as the diversion point for water to be released to the Peninsula reservoirs. The Pulgas Pump Station includes five large-capacity pumps that pump from the wet well into the Balancing Reservoir. The pump station also includes two flow-control valves that operate to allow reservoir water to flow back into the wetwell and subsequently the tunnel. The wetwell also includes two overflow weirs that allow water to flow either into the downstream Pulgas Dechloramination Facility before discharge to the UCSR, or directly to UCSR.

Maintenance. PM was performed on the pump starters and electrical switchgear equipment in 2021. In addition, reservoir cleaning was performed at the Pulgas Balancing Reservoir and will continue every few years.

Much of the facility has equipment dating back to the original construction. Proposed long-term improvements for the next few years include the replacement all of electrical switchgear and medium-voltage starters, replacement of the existing slide gate and knife gate valves, and replacement of the five vertical lift pumps.

Condition. Pulgas Pump Station is in fair condition and fit for service. However, the facility requires capital investment to address the aging equipment and deficiencies described above.

Pulgas Balancing Reservoir

Description. The Pulgas Balancing Reservoir was constructed in 1975. The Pulgas Balancing Reservoir is connected to the pump station with a single 96-inch PCCP. The reservoir has a 60-million-gallon capacity, which can augment water supply in the Peninsula during peak demands.

Maintenance. Reservoir cleaning was initiated under contract by Liquivision Technology Diving Services in September of 2020 and completed by Underwater Resources, Inc., in March 2021.

Condition. Pulgas Balancing Reservoir is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Crystal Springs Bypass Tunnel and Pipeline

Description. The Crystal Springs Bypass Facilities, which include the Crystal Springs Bypass Tunnel, New Crystal Springs Bypass Tunnel, and Crystal Springs Bypass Pipeline, allow water to be transmitted by gravity directly to the low-pressure zone pipelines on the northern portion of the Peninsula, thereby bypassing the Peninsula reservoirs and HTWTP. The Crystal Springs Bypass Tunnel and Pipeline were constructed and put into service in 1969. The New Crystal Springs Bypass Tunnel, constructed in 2011 under WSIP, is a continuation of the Crystal Springs Bypass Tunnel, providing redundancy to Crystal Springs Bypass Pipeline.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Crystal Springs Bypass Tunnel and Pipeline are in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Crystal Springs Pump Station

Description. CSPS and its associated valve lot are below LCSD. The primary purpose of these facilities is to transfer water from LCSR to San Andreas Reservoir approximately 4.5 miles north. Because LCSR has a maximum water surface elevation of 288 feet, compared to 449 feet for San Andreas Reservoir, pumping is necessary to transfer water to San Andreas Reservoir. The pump station includes four large-capacity pumps that are used in transferring water between the reservoirs. Each of these pumps is 2,250 horsepower and rated at 48 mgd. The maximum pump station capacity is 192 mgd. The water at San Andreas Reservoir is subsequently used to supply the HTWTP. CSPS was completely replaced in September 2014 as part of WSIP. The scope for the project included upgraded seismic performance, modern switchgear and starters, and variable-speed pumps. Collectively, the operational upgrades permit more off-peak pumping, which will lower power costs. By pumping during off-peak hours, SFPUC saves energy and reduces operating cost. The strategy is under consideration for use at other SFPUC facilities.

Maintenance. In FY21, warranty repair work was completed on two of four existing flow-control check valves that were showing premature wear and failure. In 2020, the UPS had also been replaced to improve the UPS reliability during utility power interruptions. Unfortunately, the newer UPS is experiencing reliability issues that have not been adequately addressed during the warranty period and will need replacement again.

Upcoming work includes a facility roof replacement project and replacement of the facility UPS. In addition, PM on the electrical switchgear equipment is scheduled to be performed in FY23.

Condition. CSPS is in good condition and fit for service. The facility requires capital investment to address the maintenance deficiencies described above.

Crystal Springs Pipelines Nos. 1, 2, and 3

Description. CSPL Nos. 1, 2, and 3 transport Hetch Hetchy and/or Sunol water to customers along the Peninsula and to the potable water terminal storage reservoirs in the City of San Francisco. CSPL No. 1 is currently not in service, except for a small, rehabilitated section. CSPL Nos. 2 and 3 both carry Hetch Hetchy water north to the City of San Francisco, across approximately 20 miles, by gravity. University Mound Reservoir is the terminus for CSPL Nos. 1, 2, and 3. The operating portions of CSPL No. 1 were replaced with 44-inch-diameter WSP in 1956. CSPL No. 2 ranges in diameter from 54 to 60 inches. Construction materials include WSP and riveted wrought iron with a sliplined WSP. CSPL No. 3 is a 60-inch PCCP.

Maintenance. CSPL No. 2, between valves K10 and K30, is a 60-inch welded steel pipeline with coal tar lining. Some of it traverses steep terrain with narrow access, making maintenance and repair difficult. An ongoing capital project will realign 1.5 miles of the pipeline, replace the existing coal tar lining, add new manholes to improve access, and make improvements to the appurtenances to meet current water quality standards.

CSPL No. 2, between valves K40 and K50, is a 60-inch welded steel pipeline with coal tar lining. An ongoing capital improvement project will replace the existing coal tar lining, add new in-line isolation valves to allow for greater operational flexibility, add new manholes to improve access, and improve appurtenances to meet current water quality standards.

Condition. CSPL Nos. 1, 2, and 3 are in fair condition and fit for service. CSPL No. 3 was inspected in November 2017 and found to be in good condition. However, CSPL No. 2 requires capital investment to address lining and access deficiencies through the CSPL No. 2 Reaches 2 and 3 Rehabilitation Project and CSPL No. 2 Reach 5 Lining Replacement Project, as described in the CIP Section 4.3.2.3.

Sunset Supply Pipeline

Description. SSPL transports water from the Hetch Hetchy System north to the City of San Francisco, across approximately 20 miles, by gravity. The pipeline is 60 inches in diameter and constructed of WSP. SSPL delivers water to the Sunset Reservoir ("high zone") after being pumped at the LMPS. Flow through the SSPL is controlled at several valves and valve lots along its alignment. The SSPL can also receive pressure-reduced high zone flow from the 60-inch Sunset Branch Pipeline via the Capuchino Pressure-Reducing Valve.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. SSPL is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Hillsborough Tunnel

Description. The Hillsborough Tunnel, collinear with the SSPL, was constructed in 1957. It is approximately 5,200 feet long and 7.5 feet in diameter. The entire length of the tunnel is lined with steel pipe.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Hillsborough Tunnel is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

San Andreas Pipelines Nos. 2 and 3

Description. SAPL Nos. 2 and 3 are the primary high zone transmission lines for the SFPUC water system. From HTWTP, SAPL Nos. 2 and 3 parallel each other up to San Pedro Valve Lot and supply water to high zone service locations in the northern Peninsula and the City of San Francisco. The terminus of SAPL No. 2 is at the Sunset Reservoir. With the extension of SAPL No. 3, constructed under WSIP, SAPL No. 3 terminates at the Merced Manor Reservoir. The completion of the Peninsula Pipelines Seismic Upgrade Project addressed seismic vulnerabilities along SAPL Nos. 2 and 3 and provided an operational work-around to ensure delivery of high-zone water to terminus reservoirs after a seismic event.

SAPL Nos. 2 and 3 are interconnected at both Baden Pump Station and San Pedro Valve Lot. At San Pedro, R60, a 42-inch butterfly valve, is throttled remotely from HTWTP to regulate high zone flow to San Francisco. SAPL No. 2 is made of 54-inch lockbar steel. SAPL No. 3 is made of 66-inch PCCP sliplined with steel, and a 36-inch steel extension from San Pedro Valve Lot to Merced Manor Reservoir.

Maintenance. SAPL No. 2 was replaced, between valves R12 and R20, in 2021. SAPL No. 2 was previously inspected in 2015 after a main break disrupted water delivery to the City of San Bruno.

Four segments of SAPL No. 2 in San Bruno had deteriorated, with severe pitting and corrosion. The capital project replaced approximately 6,500 linear feet of 54-inch-diameter lockbar steel pipe with WSP.

Condition. SAPL Nos. 2 and 3 are in fair condition. However, additional segments of lockbar steel in SAPL No. 2 are being considered for replacement due to concerns regarding corrosion. SAPL Nos. 2 and 3 are fit for service. However, SAPL No. 2 requires capital investment due to corrosion.

Capuchino Valve Lot

Description. The Capuchino Valve Lot is one of two valve lots designed to reduce pressure from the high- to low-pressure zone pipelines (the other pressure-relief valve [PRV] location is at Baden). The rated capacity of the facility is 80 mgd.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Capuchino Valve Lot is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Baden Pump Station

Description. The Baden Pump Station allows for the transfer of water from the low-pressure zone (SSPL and CSPL No. 2) into the high-pressure zone (SAPL Nos. 2 and 3) to supplement water supply from HTWTP. The pump station includes three large pumps, each rated at approximately 16.5 mgd at 255 feet discharge head. The pumps are driven by 1,000-horsepower, variable-frequency motors. Surge control vessels are provided on both the suction and discharge sides of the pump station.

Maintenance. Routine PM activities on the pumping system, compressors, backup generators, and other functions have maintained the operational reliability of the Baden Pump Station. There are no capital investments planned for this pump station at this time.

Condition. Baden Pump Station is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

Baden Valve Lot

Description. The Baden Valve Lot includes the interconnecting valves and pumps necessary to isolate pipeline reaches, transfer between the high-pressure and low-pressure zones, and transfer between pipelines of the same pressure zone.

The facility includes multiple interconnections between the two high-pressure service zone pipelines (SAPL No. 2 and SAPL No. 3) and between the four low-pressure service zone pipelines (SSPL, CSPL No. 2, CSPL No. 3, and SAPL No. 1). There is also a special energy-dissipating Monovar valve, part of the PRV station, that allows transfer of water from the high-pressure zone to the low-pressure zone.

Maintenance. No PM was required or completed during this reporting cycle.

Condition. Baden Valve Lot is in good condition and fit for service. No deficiencies in condition were noted during this reporting cycle.

San Pedro Valve Lot

Description. The San Pedro Valve Lot includes the interconnecting valves necessary to isolate pipeline reaches, transfer between the high-pressure and low-pressure zones, and transfer between pipelines of the same pressure zone.

The facility includes multiple interconnections between the two high-pressure service zone pipelines (SAPL No. 2 and SAPL No. 3) and between the low-pressure service zone pipeline (SSPL).

Maintenance. No PM was required or completed during this reporting cycle.

Condition. San Pedro Valve Lot is in good condition and fit for service. No deficiencies were noted during this reporting cycle.

4.3.2.3 Capital Improvements

Regional Water currently has 28 capital projects on its water transmission assets, representing a total capital investment of $202 million. Regional Water also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the eight active large capital projects are provided in the following sections.

As-Needed Pipeline Repair Project (Approved Budget: $7.72; Substantial Completion: 2028)

Scope. This project will repair/replace regional pipeline segments that will be inspected over the next 5 years, in addition to any emergency repairs that may be needed. The initial construction contract period will be 3 years; combined with Project 10036840, BDPL Nos. 1 through 4 Lining Repair, it will provide a sufficient guaranteed scope. Subsequent construction contract(s) will be issued to parallel WSTD's inspection program. The scope of work for the initial construction contract includes (1) pipeline replacement by open trench; (2) pipeline repair work; (3) protection of sensitive (wetland and creek) areas; (4) protection of utilities and infrastructure; (5) traffic control; (6) site/vegetation restoration; (7) paving restoration; and (8) dewatering and providing temporary safe entry measures to pipelines such as line stops, roll out spool pieces, blind flanging, and welding bulkheads. Any significant replacement needs will be addressed in subsequent expansions of this project or other independent projects.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-62.

Table 4-62: As-Needed Pipeline Repairs Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Conceptual Engineering Report	June 30, 2021

Corrosion Control (Approved Budget: $36.5 Million; Substantial Completion: 2024)

This project will implement the corrosion protection and control program recommended in the Corrosion Control Master Plan completed in August 2010. Sites identified with the worst levels of corrosion were bundled up in the master plan in three phases. Phase 1 construction work for 10 sites was completed and accepted on August 27, 2019. Phase 2 has 11 sites and is currently in the design phase. Phase 3 is anticipated to include work on as many as 20 sites.

Scope. The Corrosion Control Project includes three phases. Phase 1 was completed on August 27, 2019, and Phase 2 is currently in design phase for 11 sites. Work for Phase 2 includes (1) furnishing and installation of CP systems; (2) installation of rectifiers and anodes at a depth of approximately 300 feet; (3) installation of testing stations for pipelines; (4) installation of specialized galvanic and impressed current CP systems; (5) installation of RMUs; and (6) installation of isolation protection systems.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-63.

Table 4-63: Corrosion Control (Phase II) Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	January 4, 2017
Conceptual Engineering Report	December 29, 2017
CEQA Categorical Exemption	November 17, 2021
35% Design	December 31, 2018
95% Design	November 30, 2021

Notes:

AAR = Alternatives Analysis Report
CEQA = California Environmental Quality Act

San Antonio Pump Station Motor Control Center Upgrades Project (Approved Budget: $12.5 Million; Substantial Completion: 2024)

Scope. SAPS is one of the key facilities in the Sunol Valley; it was constructed in 1965 and modified in 1990. Several components of the facility require replacement, upgrades, or seismic retrofits. The work to be performed under this project will include (1) replacement of the existing diesel generator with a new 150-kilowatt propane generator; (2) installation of a new fire suppression system; (3) replacement of the existing lighting system; (4) replacement of the existing HVAC system; (5) architectural design that accommodates clean agent fire suppression; (6) seismic retrofit of walls; (7) replacement of the existing MCC; (8) replacement of the existing underground power and control conductors; (9) installation of new RTU with UPS; and (10) replacement of existing communication system for Control and SCADA room.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-64.

Table 4-64: San Antonio Pump Station Motor Control Center Upgrades Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
65% Design	December 30, 2021

Note:
Conceptual Engineering Report not required for San Antonio Pump Station Motor Control Center

San Andreas Pipeline No. 2 Replacement Project (Approved Budget: $45.6 Million; Substantial Completion: 2021)

Scope. SAPL No. 2 provides key water supply redundancy from the HTWTP to the Sunset Reservoir. The lockbar steel sections of SAPL No. 2 between the HTWTP and the Golden Gate National Cemetery were almost 90 years old, pitted, deteriorated, and in need of replacement. The project is in post-construction, and work included (1) replacement of approximately 5,000 feet of 54-inch-diameter pipe with WSP by open trench; (2) sliplining of approximately 1,500 feet of 54-inch-diameter pipe with 42-inch-diameter WSP; (3) site restoration work; (4) protection of utilities; (5) traffic control; and (6) pavement restoration work.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-65.

Table 4-65: San Andreas Pipeline No. 2 Replacement Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
GIR	February 23, 2017
EIR	April 12, 2017
GDR	August 1, 2017
Design Criteria Report	October 19, 2017
Bid Drawing and Specifications	September 2018
Notice to Proceed	April 9, 2019
Substantial Completion	February 12, 2019
Final Completion	July 26, 2021

Notes:
EIR = environmental impact report
GDR = Geotechnical Data Report
GIR = Geotechnical Investigation Report

BDPL Nos. 1 through 4 Lining Repair Project (Approved Budget: $10.7 Million; Substantial Completion: 2028)

Scope. This project will repair the lining in segments of BDPL Nos. 1 through 4 and other regional pipelines over the next 5 years. The duration of the Irvington Tunnel No. 2 construction contract for this project will be 3 years; combined with Project 10035029, As-Needed Pipeline Repair, it will provide a sufficient guaranteed scope. Subsequent construction contract(s) will be issued to

parallel WSTD's inspection program. Work for this project includes (1) cement CML repair, including removal, handling, and disposal of existing coal tar lining; (2) dielectric lining repair; and (3) dewatering and provision of temporary safe entry measures, such as line stops, blind flanging, roll out spool pieces, and welding bulkheads.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-66.

Table 4-66: BDPL Nos. 1 through 4 Lining Repair Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Conceptual Engineering Report	June 30, 2021

Note:
BDPL = Bay Division Pipeline

BDPL No. 4 PCCP Repair Project (Approved Budget: $54.75 Million; Substantial Completion: 2026)

Scope. In recent inspections of BDPL No. 4 Segment D, constructed of PCCP, a large number of wire breaks and circumferential cracks were found in the last 1.25 miles of pipeline that parallels Edgewood Road in Redwood City. In addition, several leaks have surfaced at circumferential cracks and where the pipeline transitions from PCCP to steel. The first construction contract will increase system reliability by rehabilitating approximately 650 feet of 84-inch-diameter BDPL No. 4 PCCP in Redwood City and will include (1) excavation, shoring, backfilling, and compaction; (2) demolition of PCCP; (3) replacement of approximately 530 feet of pipeline by open trench; (4) sliplining of approximately 120 feet of pipeline; (5) protection of sensitive (wetland and creek) areas and utilities/infrastructure; (6) traffic control; and (7) site/vegetation and paving restoration.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-67.

Table 4-67: BDPL No. 4 PCCP Repair Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
PCCP Failure Risk Analysis Report	August 15, 2022

Notes:
BDPL = Bay Division Pipeline
PCCP = prestressed concrete cylinder pipe

CSPL No. 2 Reach 5 Lining Replacement Project (Approved Budget: $23.7 Million; Substantial Completion: 2027)

Scope. CSPL No. 2 runs from CSPS to University Mound Reservoir. It delivers potable and emergency water supply to San Francisco and to several cities along the Peninsula. The 60-inch-diameter Reach 5 of CSPL No. 2, in the Cities of South San Francisco and San Bruno between

Millbrae Yard and Baden Pump Station, is more than 80 years old and has extensive lining failures. This project includes (1) replacement of approximately 3.3 miles of coal tar lining with cement mortar or dielectric lining; (2) upgrades for about 30 appurtenances to meet current standards; and (3) improvements to access and shutdown flexibility for maintenance by installing five manway structures and one 48-inch-diameter valve on SAPL No. 1 near Baden Pump Station.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-68.

Table 4-68: CSPL No. 2 Reach 5 Lining Replacement Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	August 4, 2021

Notes:
AAR = Alternatives Analysis Report
CSPL = Crystal Springs Pipeline

CSPL No. 2 Reaches 2 and 3 Rehabilitation Project (Approved Budget: $82.81 Million; Substantial Completion: 2027)

Scope. CSPL No. 2 spans from CSPS to University Mound Reservoir. It delivers potable water supply to San Francisco and several cities along the Peninsula. Reaches 2 and 3 of CSPL No. 2 in the Town of Hillsborough, unincorporated areas of San Mateo County, the City of San Mateo, and the City of Burlingame are more than 80 years old and deteriorated in some locations; Reach 2 is on slopes that are eroding and Reach 3 has extensive lining failures. This project will include (1) realignment of Reach 2 to the existing abandoned CSPL No. 1 alignment, (2) replacement of the coal tar lining of Reach 3, and (3) improvement for access to the pipeline.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-69.

Table 4-69: CSPL No. 2 Reaches 2 and 3 Rehabilitation Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	December 31, 2019
Conceptual Engineering Report Draft	~September 5, 2022
GIR	~August 31, 2022

Notes:
AAR = Alternatives Analysis Report
CSPL = Crystal Springs Pipeline
GIR = Geotechnical Investigation Report

Summary of Levels of Service Impacts

LOSs that are supported by the RWS water transmission capital improvements are provided in Table 4-70.

Table 4-70: RWS Water Transmission Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
As-Needed Pipeline Repair Project			✓					
Corrosion Control			✓					
SAPS MCC Upgrades Project		✓	✓					
SAPL No. 2 Replacement Project			✓					
BDPL Nos. 1 through 4 Lining Repair Project	✓		✓					
BDPL No. 4 PCCP Repair Project			✓					
CSPL No. 2 Reach 5 Lining Replacement Project	✓		✓					
CSPL No. 2 Reaches 2 and 3 Rehabilitation Project	✓		✓					

Notes:

BDPL = Bay Division Pipeline
CSPL = Crystal Springs Pipeline
MCC = motor control center
RWS = Regional Water System
SAPL = San Andreas Pipeline

4.4 Water Distribution Assets

4.4.1 Hetch Hetchy Water

HHWP owns and operates a network of water distribution assets that treat and distribute water to its upcountry offices, shops, and residences. These include:

Cherry Water Distribution System
O'Shaughnessy Water Distribution System
Early Intake Water Distribution System
Moccasin Water Distribution System

4.4.1.1 Asset Descriptions, Maintenance, and Condition

Cherry Water Distribution System

Description. The Cherry Water Distribution System provides fresh drinking water to 10 to 20 SFPUC and United States Forest Service (USFS) employees and families working and living in the Cherry Compound, as well as visitors to two rental cottages in the compound. The system consists of two storage tanks; a Memcor filtration system; and a water distribution system consisting of water lines, pipes, and valves of various sizes. Water is sourced from a small diversion dam on Cottonwood Creek.

Maintenance. Table 4-71 summarizes maintenance work.

Table 4-71: Cherry Water Distribution System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Water Sampling	Completed weekly	Sampled for chemistry and bacterial agents
Instrument Verification and Calibration	Completed weekly	Instruments verified weekly
	Completed monthly	Instruments recalibrated monthly
Inspection	Completed weekly	Facility inspected by HHWP Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via internal dataloggers

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance

Condition. Cherry Water Distribution System is in fair to good condition and fit for service; however, given the asset's age, an updated condition assessment is recommended. A project to replace the Memcor Water Filter Plant has been initiated.

O'Shaughnessy Water Distribution System

Description. O'Shaughnessy Water Distribution System provides fresh drinking water to one to five SFPUC and National Park Service (NPS) employees and families working and living in the O'Shaughnessy Compound, as well as visitors to four rental cottages in the compound. The system consists of two storage tanks; a UV facility; and a water distribution system consisting of water lines, pipes, and valves of various sizes. Water is sourced directly from Hetch Hetchy Reservoir at O'Shaughnessy Dam.

Maintenance. Table 4-72 summarizes maintenance work.

Table 4-72: O'Shaughnessy Water Distribution System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Water Sampling	Completed weekly	Sampled for chemistry and bacterial agents
Instrument Verification and Calibration	Completed weekly	Instruments verified weekly
	Completed monthly	Instruments recalibrated monthly
Inspection	Completed twice weekly	Facility inspected by HHWP Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via SCADA alarms

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. O'Shaughnessy Water Distribution System is in fair to good condition and fit for service; however, given the age of the water distribution piping, an updated condition assessment is recommended.

Early Intake Water Distribution System

Description. The Early Intake Water Distribution System provides fresh drinking water to five to 15 SFPUC, NPS, and USFS employees and families working and living in the Early Intake Area; Kirkwood Powerhouse; and visitors to the Early Intake Bunkhouse. The system consists of two storage tanks; a UV facility; and a water distribution system consisting of water lines, pipes, and valves of various sizes. Water is sourced from Hetch Hetchy Reservoir via Kirkwood Powerhouse.

Maintenance. Table 4-73 summarizes maintenance work.

Table 4-73: Early Intake Water Distribution System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Water sampling	Completed weekly	Sampled for chemistry and bacterial agents
Instrument Verification and Calibration	Completed weekly	Instruments verified weekly
	Completed monthly	Instruments recalibrated monthly
Inspection	Completed thrice weekly	Facility inspected by HHWP Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via SCADA alarms

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Early Intake Water Distribution System is in fair to good condition and fit for service; however, given the age of the water distribution piping, an updated condition assessment is recommended.

Moccasin Water Distribution System

Description. Moccasin Water Distribution System provides fresh drinking water to approximately 300 SFPUC employees and residents who work or reside in the town of Moccasin. The system consists of three storage tanks; a UV facility; and a water distribution system that consists of water lines, pipes, and valves of various sizes. Water is sourced from Hetch Hetchy Reservoir via Moccasin Penstock.

Maintenance. Table 4-74 summarizes maintenance work.

Table 4-74: Moccasin Water Distribution System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Water Sampling	Completed daily	Sampled for chemistry and bacterial agents
Instrument Verification and Calibration	Completed weekly	Instruments verified weekly
	Completed monthly	Instruments recalibrated monthly
Inspection	Completed daily	Facility inspected by HHWP Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via SCADA alarms

Notes:
HHWP = Hetch Hetchy Water and Power
PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. Moccasin Water Distribution System is in fair to good condition and fit for service; however, given the age of the water distribution piping, an updated condition assessment is recommended.

4.4.1.2 Capital Improvements

There are no capital improvements for HHWP's Water Distribution assets included in the current 10-year capital plan.

4.4.2 Regional Water

Beside the maintenance and operations of the large-diameter transmission pipelines, Regional Water provides retail water service to a small number of individual residential and commercial customers outside of San Francisco. Retail operations in RWS are limited to distribution systems in Sunol.

4.4.2.1 Asset Descriptions, Maintenance, and Condition

Town of Sunol

Description. Sunol, with approximate population of 250 people, receives their potable and raw water from SFPUC via two 12-inch pipelines. These are the only sources of water into Sunol and cannot be shut down for a significant period of time.

The Sunol potable water pipeline is 12 inches in diameter and consists of transmission and distribution lines. The transmission line runs in the south-to-north direction, starts at the western end of the mixing chamber on the AWP, parallels Calaveras Road for the most part, crosses I-680, and ends at the Town of Sunol Pump Station in Sunol Yard. The 12-inch Sunol raw water pipeline is fed by the San Antonio Pipeline. It starts at Valve Y-35 (an isolation valve on the San Antonio Pipeline) and follows the same alignment as the potable pipeline that ends at Sunol Yard.

The Sunol potable water distribution pipeline varies in size. Beginning at the Town of Sunol Pump Station, it runs uphill to feed two 120,000-gallon storage tanks. The main pressure zone, which serves the majority of the population of Sunol, is gravity-fed, supplied by the tanks. The secondary pressure zone, along Kilkare Road in the upper elevation (north of the primary zone), requires the assistance of the Kilkare Booster Pump Station to service water through a 6-inch steel line to the residences in this zone.

The majority of the 12-inch Sunol potable and raw water pipelines were replaced with new mortar-lined ductile iron pipe in 2000 and 2013, from the AWP to Sunol Yard. A completed WSIP project, the Sunol Fire Suppression System Project (2016), upgraded segments of the distribution system and added a dedicated pipeline for firefighting purposes. A separate project completed by WSTD in 2017 added a dedicated fire pump to boost firefighting pressure to the secondary pressure zone. With the new Town of Sunol Fire Pump in place, both the primary and secondary pressure zones now have adequate firefighting volume and pressure.

Segments of the Sunol's water system have been upgraded through a succession of projects in the past, but there are segments of pipeline from the original construction that are still operable today.

Maintenance. The 12-inch Sunol pipeline, which crosses Arroyo de la Laguna in Sunol, was originally installed below the creek bed. However, with erosion, the pipeline is now completely exposed. This section of the pipeline feeds both the potable and firefighting waterlines to Sunol. A capital project has been initiated to replace the section of the pipeline crossing the creek.

A portion of the 12-inch Town of Sunol potable and raw waterlines conflicts with Alameda County Transportation Commission's (ACTC) project to widen I-680. A partial replacement would introduce a potential point of failure in Caltrans' ROW. In consideration of this, SFPUC requested a complete replacement across the freeway and funded a portion of the replacement outside of ACTC's work limit. The construction for the replacement section began in 2021.

In November 2021, two leaks were reported on the Town of Sunol 12-inch raw water line. The leaks occurred in the construction site of ACTC's project to widen I-680. The leaks, caused by corrosion, were repaired with leak clamps. To minimize point loads, ACTC has since installed steel plates over the 12-inch potable and raw waterlines. The corroded sections of the 12-inch raw waterline will be replaced at the end of ACTC's project.

Condition. Sunol potable and raw waterlines are in good condition and fit for service. However, the facilities require capital investment to replace the segments across the creek and I-680 through the Town of Sunol Pipeline Improvement Project, as described in Section 4.4.2.2.

4.4.2.2 Capital Improvements

Regional Water currently has one active capital project on its water distribution assets, representing a total capital investment of $6.66 million.

Town of Sunol Pipeline Improvement Project (Approved Budget: $6.66 Million; Substantial Completion: 2025)

Scope. Since the Year 2000, SFPUC has replaced all but two segments of the Town of Sunol pipeline system through the Town of Sunol Fire Suppression project. This project will complete the replacement of the last two segments, replacing sections of the pipeline that cross the Arroyo de Laguna Creek (Creek Crossing) and under I-680. The upstream section of pipeline, which feeds both the potable line and fire suppression line to Sunol, is exposed under the creek and in danger of failing under I-680. Pipeline failure at either location has significant consequences because all fire and potable water in Sunol is dependent on the rehabilitation of this 12-inch line. This project will reduce unplanned outages from pipe breaks and improve on delivery reliability.

This project is broken up into two portions. The scope of work is summarized in the following paragraphs.

Creek Crossing

- Replace approximately 550 feet of 12-inch-diameter pipeline crossing Arroyo de Laguna Creek with 12-inch-diameter Ductile Iron Pipe (DIP), class 53
- Open-cut trench across the creek
- New tie-in points with gate valves
- Creek restoration and tree removal in pipeline alignment

I-680 Crossing

- MOU agreement with Alameda County Transportation Commission (ACTC) to replace existing 12-inch-diameter Town of Sunol pipelines under I-680 for $1.3 million

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-75.

Table 4-75: Town of Sunol Pipeline Improvement Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	November 2017
Conceptual Engineering Report	November 2021

Note:
AAR = Alternatives Analysis Report

4.5 Buildings and Grounds

SFPUC owns and operates multiple buildings and grounds facilities that are spread over a large geographical area to support the O&M of RWS.

4.5.1 Hetch Hetchy Water

HHWP is responsible for the O&M of multiple buildings and grounds assets throughout its operational territory. Staff-assigned reporting facilities include:

Moccasin Compound
South Fork Yard
Oakdale Yard
Warnerville Yard

In addition to the above-listed facilities, HHWP also operates and maintains smaller-scale buildings and grounds facilities at Eleanor, Cherry, O'Shaughnessy, Early Intake, and Rock River.

4.5.1.1 Asset Descriptions, Maintenance, and Condition

Moccasin Compound

Description. Moccasin Compound is the main corporate yard for HHWP. The Administration Building is occupied by HHWP's Management, Engineering, Business Services, Water and Power Operations, Asset Management Services, Strategic Capital Planning and Special Projects, and Power Compliance groups. All groups at the compound are housed in either the administration facility, building, shop, or trailers. Staff support for the larger working groups are discussed in the following paragraphs.

- Engineering staff: Operating groups include Maintenance Engineering, Renewal and Replacement Projects, and Information Technology (IT) Services. Maintenance Engineering comprises the civil, mechanical, and electrical disciplines, including drafting and surveying support. IT Services includes operating technology, IT, and SCADA staff.

- Business Services: Operating groups include Budget and Finance for Operating and Capital; Contracts; Records; Property Management; Personnel, Training, and Recruitment; and Materials Procurement and Management.

- Water and Power Operations: Staff includes power system operators (who also perform dispatch); power transmission system east linemen, who maintain overhead electrical lines from O'Shaughnessy to Don Pedro Reservoir; operation transmission planning engineers; water and power planning staff; watershed management staff; plumbers shop staff; equipment maintenance shop staff; carpenter shop staff; electrical shop staff; paint shop staff; tech shop staff; ROW crew for the area from Priest Watershed to Newark; and vegetation management crew for the entire project area.

- Asset Management Services: Staff includes planners, schedulers, and asset services. Security is also included in this work team.

In addition to HHWP staff, multiple trailers house infrastructure teams, water quality staff and labs, and NRLMD staff who support HHWP maintenance and programs.

Maintenance. Table 4-76 summarizes maintenance work.

Table 4-76: Moccasin Compound Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed monthly	Security inspection
	Completed monthly	Safety inspection
	Completed monthly	Spill prevention control and countermeasures
	Completed annually	Facility fire suppression testing
Maintenance	Completed monthly	Backup generator maintenance
	Completed annually	Defensible space vegetation clearing
	Completed every 3 years	Domestic water tanks maintenance

Note:
PM = preventive maintenance

Condition. There are many offices and storage facilities in Moccasin Compound. The condition of these facilities varies greatly; the use of some buildings is limited due to their condition (e.g., the Old Moccasin Powerhouse). Needs continue to be addressed and capital projects identified.

South Fork Yard

Description. South Fork Yard is east of the town of Groveland. The yard is occupied by the South Fork ROW maintenance crew. This crew maintains HHWP facilities from O'Shaughnessy to the eastern side of the Priest Reservoir watershed.

Maintenance. Table 4-77 summarizes maintenance work.

Table 4-77: South Fork Yard Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed monthly	Security inspection
	Completed monthly	Safety inspection
	Completed monthly	Spill prevention control and countermeasures
	Completed bi-annually	Facility fire suppression testing
Maintenance	Completed annually	Defensible space vegetation clearing

Note:
PM = preventive maintenance

Condition: The South Fork Yard is fit for service.

Oakdale Yard

Description. Warnerville Compound is east of the city of Oakdale. The yard is occupied by maintenance engineering staff dedicated to the HHWP facilities west of Don Pedro Reservoir.

Maintenance. Table 4-78 summarizes maintenance work.

Table 4-78: Oakdale Yard Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed monthly	Security inspection
	Completed monthly	Safety inspection
	Completed monthly	Spill prevention control and countermeasures
Maintenance	Completed annually	Defensible space vegetation clearing

Note:
PM = preventive maintenance

Condition: The Oakdale Yard is fit for service.

Warnerville Yard

Description. Warnerville Compound is east of the city of Oakdale. The yard is occupied by power transmission system west linemen who maintain overhead electrical lines from Don Pedro Reservoir to Newark. It should be noted that the power transmission system west linemen also support maintenance of overhead electrical lines owned by WSTD.

Maintenance. Table 4-79 summarizes maintenance work.

Table 4-79: Warnerville Yard Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed monthly	Security inspection
	Completed monthly	Safety inspection
	Completed monthly	Spill prevention control and countermeasures
	Completed bi-annually	Facility fire suppression testing
Maintenance	Completed annually	Defensible space vegetation clearing

Note:
PM = preventive maintenance

Condition The Warnerville Yard is fit for service.

4.5.1.2 Capital Improvements

HHWP currently has two active capital projects on its buildings and grounds assets, representing a total capital investment of $13.7 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the active large capital projects are provided in the following sections.

Moccasin Old Powerhouse Hazard Mitigation (Approved Budget $12.2 Million; Substantial Completion: 2024)

Scope. The scope for this project is to design and install mitigation measures to prevent the building from collapsing due to multiple structural and nonstructural issues, and to prevent hazardous materials (such as lead-based paint and asbestos) from contaminating the water in Moccasin Reservoir.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-80.

Table 4-80: Moccasin Old Powerhouse Hazard Mitigation Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
NAR	February 2022

Note:
NAR = Needs Assessment Report

Moccasin Engineering and Records Building (Approved Budget $1.5 Million; Substantial Completion: Not Applicable)

Scope. The scope for this project is to complete an AAR and Conceptual Engineering Report to support the objective of the design and construction of a 25,000-square-foot building. The building will provide adequate office space for current staff in Moccasin, as well as a new records and archives space with offices; a new space for servers currently stored in the basement of the existing Administration Building; and increased parking space for staff.

Milestones Completed During the Reporting Cycle. The project is scheduled and budgeted to begin in 2023; therefore, no milestones were achieved during this reporting cycle.

Summary of Levels of Service Impacts

LOSs that are supported by the HHWP buildings and grounds assets capital improvements are provided in Table 4-81.

Table 4-81: HHWP Buildings and Grounds Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Moccasin Old Powerhouse Hazard Mitigation	✓		✓					
Moccasin Engineering and Records Building			✓					

Note:
HHWP = Hetch Hetchy Water and Power

4.5.2 Regional Water

WSTD owns and operates multiple buildings and grounds facilities, spread over a large geographical area, that support the O&M of RWS.

4.5.2.1 Asset Descriptions, Maintenance, and Condition

Sunol Yard

Description. Sunol Yard is a newly built East Bay corporation yard. It has an Administration Building occupied by WSTD and NRLMD; the rest of the yard is shared by utility plumbers, electricians, electronic maintenance technicians, and the auto, welding, painting, and buildings and grounds shops. It is also the operational hub for East Bay gardeners, carpenters, house plumbers, custodians, and stationary engineers. Sunol Yard is surrounded by the Water Temple, the new Alameda Creek Watershed Center, the Sunol Native Plant Nursery, and the shared Hetch Hetchy Yard used for storage.

Maintenance. Between July 1, 2020, and June 30, 2022, WSTD performed PM on the newly built yard Sunol Yard. R&R projects for the paint/blast booths, emergency generator, vehicle wash, and main entrance and exit gates will be addressed in FY23 and FY24.

Condition. The Sunol Yard is in very good condition.

Millbrae Yard

Description. Millbrae Yard is the main corporate yard for WSTD. The Administration Building is occupied by WSTD management; engineering; administration; water treatment; distribution operations; maintenance; 24-hour dispatch; planners; IT; and water quality labs, offices, and cubicles. There is a warehouse for supplies, auto shop, gardener shop, carpenter shop, electrician shop, house plumber shop, welding shop, paint shop, and a utility plumbers shop. NRLMD has a cottage and a trailer.

Maintenance. WSTD performed PM between July 1, 2020, and June 30, 2022. The Administration Building was built in the late 1960s, and its mechanical equipment is nearing the end of its useful life. Both the yard security upgrade and building HVAC system repairs will begin in FY23.

Condition. The Millbrae Yard buildings are aging but in fair condition.

Rollins Road

Description. Rollins Road is the administrative headquarters for the WQD. This facility is occupied by the WQD Administration, Engineering, and Field Services sections, as well a variety of NRLMD staff (planners, biologists, etc.), and WSTD surveyors. In addition to office space and cubicles, the facility serves is the operational hub of the sample monitoring group, storing cars and field monitoring equipment.

Maintenance. WSTD and various vendors performed preventive and as-needed maintenance for this facility between July 1, 2020, and June 30, 2022. This facility, which was previously leased, was purchased in 2017. In FY22, a security upgrade was started to add fencing and access control;

this upgrade should be completed in early FY23. Also in FY23, minor renovations will be conducted to increase the number of work spaces for staff, and two HVAC units will be replaced.

The roof was patched in places over the garage and the southwest portion of the facility. Additionally, an often-failing HVAC unit dedicated to the server room required repairs several times. Ongoing efforts to improve employee safety included the purchase and installation of portable air cleaners for use in common areas in which social distancing cannot be maintained. Planned upgrades to the Millbrae Corporation Yard include space into which Rollins Road staff may eventually relocate. Such plans have balanced management decisions between short-term remedies and major investments in this facility.

Condition. Rollins Road building is aging but in fair condition.

4.5.2.2 Capital Improvements

Regional Water currently has 10 active capital projects on its buildings and grounds assets, representing a total capital investment of $191.6 million. Regional Water also has multiple R&R projects that are smaller in scope and budget, and are reported annually. Summaries for each of the active large capital projects are provided in the following sections.

Rollins Road Building Renovation (Approved Budget: $5.2 Million; Substantial Completion: 2021)

Scope. SFPUC purchased a property on Rollins Road in September 2017, securing an additional 10,000 square feet of office space for the SFPUC WE. In June 2020, the project scope for 1657 Rollins Road was decreased significantly, and the scope of the Millbrae Yard Lab and Shop Project was increased. The program for Rollins Road Building Renovation Project will be achieved at the Millbrae Yard by adding two additional floors to the laboratory building as part of its Phase 1 project. The expanded laboratory building will accommodate the Rollins Road building staff. As a result of the scope change, personnel at 1657 Rollins Road will relocate to Millbrae Yard campus following the completion of the Millbrae Yard Lab and Shops Project. The project at 1657 Rollins Road will implement exterior security improvements, including (1) 800 linear feet of 8-foot-high chain link fencing; (2) three pedestrian and two vehicular gates with card readers; (3) new security lighting for the parking lot west of the building; (4) electrical work to support new exterior lighting and security infrastructure; (5) eight exterior and three interior security cameras; and (6) integration of new security devices with existing Galaxy and Milestone software.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-82.

Table 4-82: Rollins Road Building Renovation Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Environmental Approval	October 30, 2020
Construction Notice to Proceed	December 8, 2020
Substantial Completion	October 20, 2021

Millbrae Warehouse Settlement and Administration Building HVAC (Approved Budget: $16.1 Million; Substantial Completion Scope I: 2021; Substantial Completion Scope II: 2023)

This project will cover the cost of construction repairs for two buildings—the Millbrae Warehouse and the Administration Building—in the Millbrae Yard facility.

Scope I. For the Millbrae Warehouse Settlement project, a long-term fix will be provided for the displacement (settlement) of the slab between the loading dock and the offices. The slab settlement resulted from expansive clay layers 7 feet below the top of the existing concrete slab. The scope of work for Millbrae Warehouse Settlement includes (1) replacement of soil below the existing loading dock with drainage gravel and aggregate base; (2) installation of a drain for the existing eyewash shower; (3) replacement of the existing slab with a new loading dock slab and retaining wall; (4) modification of downspouts to discharge the water away from the loading dock retaining wall and warehouse; and (5) installation of weep holes along the bottoms of retaining walls; and (6) installation of appurtenances.

Scope II. For the Millbrae Administration Building HVAC upgrades, this project will provide a long-term reliable and economical solution to heating and cooling demands. The scope of work for Millbrae Administration Building HVAC upgrades includes (1) removal of the outdated main HVAC units from the mezzanine level; (2) placement of the main components of the new HVAC system outside of the building; (3) installation of the duct work system through the existing louver openings; and (4) leasing of the mobile laboratory trailer during construction.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-83.

Table 4-83: Millbrae Warehouse Settlement and Administration Building HVAC Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Scope I: Environmental Approval (CatEx)	August 31, 2020
Scope I: Bid Advertisement	September 1, 2020
Scope I: Construction Notice to Proceed	June 16, 2021
Scope I: Final Completion	November 24, 2021
Scope II: No Substantial Modification to CatEx	January 12, 2022

Notes:
CatEx = categorical exclusion
HVAC = heating, ventilation, and air conditioning

Millbrae Yard Laboratory and Shop Improvements (Approved Budget: $169.6 Million; Substantial Completion: 2028)

The Millbrae Yard campus improvements will be implemented in three phases. Phase 1 includes a new laboratory and new south shop building to alleviate WE's undersized and outdated work spaces and desire to relocate mission-critical functions to code-compliant structures. This project will provide additional space in the laboratory building by constructing two additional floors to accommodate the relocation of all personnel from the Rollins Road Facility. Phase 2 includes

demolition of the existing Administration Building and construction of a new consolidated Administration Building adjacent to the new laboratory building to accommodate other WE staff. Phase 3 includes construction of new covered storage for materials and equipment. Only the scope of work for Phase 1 will be implemented under this project, to meet near-term needs, minimize disruptions to operations, and allow gradual buildout of the master plan to stay within the 10-year CIP budget.

Scope. The Millbrae Yard campus improvements will be implemented in three phases. Phase 1 includes a new laboratory and new south shop building; Phase 2 includes demolition of the existing Administration Building and construction of a new consolidated Administration Building; Phase 3 includes construction of new covered storage for materials and equipment. This project includes planning for all three phases, but only design and construction for Phase 1. Work for Phase I includes (1) construction of a new 50,000-square-foot, three-story laboratory building; (2) construction of a new 12,800-square-foot shop building; (3) renovation of an existing 7,440-square-foot warehouse; and (4) performance of site improvements such as driveways, hardscape, landscape, and parking (approximately 400 spaces).

Milestones Completed During the Reporting Cycle. No milestones were achieved by the project during this reporting cycle, but project planning continues to progress.

Table 4-84: Millbrae Yard Laboratory and Shop Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Project planning in progress	Pending

Sunol Long-Term Improvements (Approved Budget: $104.9 Million; Substantial Completion Scope I: 2020; Scope II: 2021)

Scope. The project includes redevelopment of the existing Sunol Yard (Scope I) and construction of a Watershed Center (Scope II) near the Sunol Water Temple. The Sunol Yard construction work was completed on September 4, 2020. Work for Watershed Center includes (1) construction of a one-story LEED Gold facility that will include an interpretive display exhibit area, a freshwater stream profile aquarium, history display alcoves, a watershed discovery lab classroom, a community multi-purpose room, restrooms, an entry plaza, a reception area, patios, and administrative offices; (2) construction of a 2.5-acre discovery trail area with native plant landscaping, irrigation, meandering trails, seating areas, and water and landscape features; (3) site restoration of the temple area forecourt; (4) construction of new stairs and ramps to the picnic area; (5) installation of underground utilities; and (6) site restoration and paving.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-85.

Table 4-85: Sunol Long-Term Improvements Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Scope I: Final Completion	September 15, 2020
Scope II: Substantial Completion	December 16, 2021

Summary of Levels of Service Impacts

LOSs that are supported by the RWS buildings and grounds capital improvements are provided in Table 4-86.

Table 4-86: RWS Buildings and Grounds Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Rollins Road Building Renovation			✓					
Millbrae Warehouse Settlement and Administration Bldg. HVAC			✓					
Millbrae Yard Laboratory and Shop Improvements			✓					
Sunol Long-Term Improvements			✓				✓	✓

Notes:

HVAC = heating, ventilation, and air conditioning
RWS = Regional Water System

4.6 Power Generation Assets

SFPUC owns and operates multiple power generation assets, including high-head and low-head hydropower houses. These assets are all operated and maintained within the Hetch Hetchy Water system.

4.6.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of multiple power generation assets, most of which are integral to its water delivery system. These assets include:

Holm Powerhouse
Kirkwood Powerhouse
Moccasin Powerhouse
Moccasin Low Head Powerhouse

4.6.1.1 Asset Descriptions, Maintenance, and Condition

Asset descriptions, maintenance, and condition for the HHWP power generation assets are provided in the following sections, organized from upstream to downstream. A summary of the assets organized by classification is included in Table A-12 of Appendix A.

Holm Powerhouse

Description. Holm Powerhouse has two generating units, with a combined maximum output of 171 MW at a maximum flow of 1,010 cfs. The distributor floor, turbine floor, and generator floor are inside the powerhouse. The turbines are vertical, impulse type, with six jets and deflectors directing water to the exposed, nonsubmerged, runner. The turbine discharges into an open waterway that daylights into the tailrace area and into Cherry Creek.

Each generating unit has three single-phase, 230: 13.8-kilovolt (kV) step-up transformers installed outdoors on the transformer deck adjacent to the generator floor. The transformers are connected to the indoor 13.8 kV switchgear and the Early Intake Switchyard. Holm Powerhouse is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-87 summarizes maintenance work.

Table 4-87: Holm Powerhouse Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Security inspections
	Completed annually	Annual vegetation inspection
Maintenance	Completed annually	Annual maintenance shutdown for generating units 1 and 2

Note:
PM = preventive maintenance

Condition. Holm Powerhouse and its systems are in good condition. Many of the plant's auxiliary systems and controls were recently replaced and/or updated during the HH-989 Contract. The generators each have had a rewind project to refurbish and extend their useful life. The generator step-up transformers are in good condition and should be monitored for condition and performance. The turbine shut-off valve (TSOV) for each unit is in only fair condition due to its age; this has required HHWP to increase its nonroutine maintenance activities.

Kirkwood Powerhouse

Description. Kirkwood Powerhouse has three generating units, with a combined maximum output of 126 MW at a maximum flow of 1,350 cfs. The distributor floor, turbine floor, generator floor, and control room are inside the powerhouse. The turbines are vertical, impulse-type, with six jets and deflectors directing water to the exposed, nonsubmerged, runner. The turbine discharges into an enclosed waterway connecting to Early Intake Bypass Tunnel.

Each generating unit has three single-phase, 230:13.8 kV step-up transformers installed outdoors on the transformer deck adjacent to the generator floor. The transformers are connected to the indoor 13.8 kV switchgear and Early Intake Switchyard.

Kirkwood Powerhouse has a water bypass and energy dissipation system used to convey water from the penstock to the bypass chamber and onto Mountain Tunnel. Kirkwood Powerhouse is in a Tier 2 High Fire Threat District

Maintenance. Table 4-88 summarizes maintenance work.

Table 4-88: Kirkwood Powerhouse Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Security inspections
	Completed annually	Annual vegetation inspection
Maintenance	Completed annually	Annual maintenance shutdown for generating units 1, 2, and 3

Note:
PM = preventive

Condition. Kirkwood Powerhouse and its systems are in marginal condition. Some systems have been updated, due to the overall age of the powerhouse and because associated systems may have reached the end of their useful life. In 2009-2010, a generator rewind performed on units 1 and 2, which are still within their expected useful life. Capital investment will be required to update and overhaul unit 3 and the plant auxiliaries. Additionally, the water bypass and energy dissipation system is in poor condition; it has required extensive repairs over the past 10 years, with limited use. Capital investment will be required to upgrade or replace the system for long-term, reliable service.

Moccasin Powerhouse

Description. Moccasin Powerhouse has two generating units, with a combined maximum output of 110 MW at a maximum flow of 1,340 cfs. The distributor floor, turbine floor, and control room are inside the powerhouse, with the generator housing exposed to the outdoors. The turbines are impulse-type, with six jets and deflectors directing the water to the exposed, nonsubmerged runner. The turbine discharges into an open waterway, which daylights into the tailrace area.

The 115/230:13.8 kV step-up transformers are just outside the powerhouse. The transformers are connected to the indoor switchgear and the Moccasin Switchyard adjacent to the powerhouse.

Moccasin Powerhouse has two water bypass and energy dissipation systems used to convey water from the penstocks to the tailrace when generation units are not available. Moccasin Powerhouse is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-89 summarizes maintenance work.

Table 4-89: Moccasin Powerhouse Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Security inspections
	Completed annually	Annual vegetation inspection
Maintenance	Completed annually	Annual maintenance shutdown for generating units 1 and 2

Note:
PM = preventive maintenance

Condition. Moccasin Powerhouse and its systems are in marginal condition. Due to the overall age of the powerhouse and associated systems, many have reached the end of their useful life. There are ongoing capital projects to upgrade and refurbish the generators, generator step-up transformers, and plant auxiliary systems. The TSOV is in marginal condition and has required extensive nonroutine maintenance. Capital investment will be required to refurbish and increase reliable performance of the TSOV. Additionally, the water bypass and energy dissipation systems are in poor condition. There is an ongoing capital project to update and replace these systems.

Moccasin Low Head Powerhouse

Description. Moccasin Low Head Powerhouse has one horizontal unit with a generator rated at 3,750 kVa. The turbine is a Francis type that discharges into a draft tube connected to the tailrace. The powerhouse has three levels: the mezzanine, turbine floor, and generator pit.

The generator has a three-phase 13.8:4.16 kV step-up transformer outside near the powerhouse. The transformer is connected to the indoor 4.16 kV breaker and the Moccasin Switchyard. Moccasin Low Head Powerhouse is in a Tier 2 High Fire Threat District.

Maintenance. No PM was required or completed during this period.

Condition. Moccasin Low Head Powerhouse is in poor condition due to the age of the systems and damage incurred during the March 2018 flood. A project is underway to remediate the damage and have the powerhouse operational by spring 2023. Additional capital investment may be required at a later date to modernize the powerhouse systems for reliable operations.

4.6.1.2 Capital Improvements

HHWP currently has four active capital projects on its power generation assets, representing a total capital investment of $118.6 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of these active large capital projects are provided in the following sections.

Other Powerhouse Projects (Approved Budget: $20.7 Million; Substantial Completion: 2021)

Scope. This project provided funding for Holm Powerhouse (HPH) Unit 2 upgrades and other items under $1 million involving power generation renewal and equipment replacement. Additionally, this project included upgrades to turbine and generators, and to AC stations intended to extend the life of the unit by 20 years. Lastly, the project upgraded the existing oil containment systems at Kirkwood Powerhouse (KPH) and HPH to prevent oil discharge into the environment.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-90.

Table 4-90: Other Powerhouse Projects Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
Construction Complete (Holm Powerhouse Rehabilitation and Kirkwood Powerhouse Oil Containment)	November 29, 2020
Construction Complete (Cherry Valve House – Bypass Fill Valve for Cherry Power Tunnel)	May 14, 2021

Kirkwood Powerhouse Bypass Upgrades (Approved Budget $16.2 Million; Substantial Completion: 2035)

Scope. The objective for this project is to provide a reliable hydraulic bypass and energy dissipation system, conveying water around the turbines to the Kirkwood Powerhouse Bypass Chamber and Mountain Tunnel. The scope will be to upgrade/replace the high-pressure energy dissipating valves, control systems, and associated structures to absorb 1,245 feet of pressure head and a flow of 430 cubic feet per second (cfs) without damage.

Milestones Completed During the Reporting Cycle. The project is scheduled and budgeted to begin in 2027; therefore, no milestones were achieved during this reporting cycle.

Moccasin Powerhouse Bypass Upgrade (Approved Budget: $15.0 Million; Substantial Completion 2027)

Scope. The objective for this project is to provide a reliable hydraulic bypass and energy dissipation system, conveying water around the turbines to the Moccasin Reservoir Bypass Pipeline. The scope will be to upgrade/replace the high-pressure energy dissipating valves, control systems, and associated structures to absorb 1,147 feet of pressure head and a flow of 430 cfs without damage.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-91.

Table 4-91: Moccasin Powerhouse Bypass Upgrade Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
NAR (Draft)	July 2021
NAR (Final)	October 2021
AAR (Draft)	January 2022
AAR (Final)	March 2022

Note:

AAR = Alternatives Analysis Report
NAR = Needs Assessment Report

Moccasin Powerhouse and GSU Rehabilitation (Approved Budget: $66.7 Million; Substantial Completion: 2027)

Scope. The project scope is separated into three phases of work: (1) Phase 1 – Generator Rehabilitation, which will replace the stator cores and coils for both generator units that have exceeded their life expectancy; (2) Phase 2 – Generator Step-Up (GSU) Replacement, which will replace two GSU transformers; and (3) Phase 3 – Power Plant Systems Upgrades, which will involve power plant systems upgrades, including replacing the 480 V switchgear, 13.8 kV switchgear, MCCs, main control boards, protective relays, cooling water piping, and improving oil containment systems.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-92.

Table 4-92: Moccasin Powerhouse and GSU Rehabilitation Project Milestones Completed During the Current Reporting Cycle

Phase	Milestones	Completion Date
	CatEx	September 28, 2020
Phase 1	DB-121R2 – Advertised Design-Build Contract	October 30, 2020
	DB-121R2 – Readvertised Design-Build Contract	January 2021
	DB-121R2 – Issued Design Notice to Proceed	June 21, 2021
	DB-121R2 – 65% Design	December 2021
	DB-121R2 – 95% Design	June 2022
Phase 2	HH-1003 – Advertised Construction Contract	November 20, 2020
	HH-1003 – Issued Construction Notice to Proceed	June 7, 2021
	HH-1003 – GSU1 Installation	March 2022
Phase 3	NAR	August 2021

Notes:

CatEx = categorical exclusion
GSU = generator step-up
NAR = Needs Assessment Report

Summary of Levels of Service Impacts

LOSs that are supported by the HHWP power generation capital improvements are provided in Table 4-93.

Table 4-93: HHWP Power Generation Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Other Powerhouse Projects			✓			✓		✓
Kirkwood Powerhouse Bypass Upgrades			✓			✓		✓
Moccasin Powerhouse Bypass Upgrade			✓			✓		✓
Moccasin Powerhouse and GSU Rehabilitation			✓			✓		✓

Notes:

GSU = generator step-up
HHWP = Hetch Hetchy Water and Power

4.7 Power Transmission Assets

SFPUC owns and operates multiple power transmission assets, including high-voltage transmission lines, towers, substations, and switchyards. These assets are all operated and maintained within the Hetch Hetchy Water system.

4.7.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of multiple power transmission assets, most of which are integral to its water delivery system. HHWP performs 5-year inspection on all transmission towers (climbing each tower) and prepares maintenance as needed. These inspections are not included in the maintenance tables. Transmission assets include:

Power Transmission Lines 1 and 2
Power Transmission Lines 3 and 4
Power Transmission Lines 5 and 6
Power Transmission Lines 7 and 8
Power Transmission Lines 9, 10, and 11
Intake Switchyard
Moccasin Switchyard
Warnerville Substation
Calaveras Substation

4.7.1.1 Asset Descriptions, Maintenance, and Condition

Asset descriptions, maintenance, and condition for the HHWP power transmission assets are provided in the following sections.

Power Transmission Lines 1 and 2

Description. Power Transmission Lines 1 and 2 are used to transmit power from Holm Powerhouse to the Intake Switchyard. This asset consists of 1.55 miles of two three-phase conductors that transmit power at a voltage of 230 kV, with 1.5 miles traversing a Tier 2 High Fire Threat District. Supporting the towers is a series of seven lattice steel towers.

Maintenance. Table 4-94 summarizes maintenance work.

Table 4-94: Transmission Lines 1 and 2 Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
Vegetation Inspection and Removal	Completed annually	Vegetation treatment in accordance with the Transmission Vegetation Management Plan
Maintenance	Completed annually	Completed as needed

Note:
PM = preventive maintenance

Condition. Transmission Lines 1 and 2 are in good condition and fit for service; however, given the asset's age, an updated condition assessment is planned to be completed by late 2025. Additionally, there is one site that requires mitigation for "hard clearance."[3]

Power Transmission Lines 3 and 4

Description. Power Transmission Lines 3 and 4 are used to transmit power from Moccasin Powerhouse to Calaveras Substation, as well as TID's Oakdale Substation and PG&E's Newark Substation. This asset consists of 98.6 miles of two three-phase conductors that transmit power at a voltage of 115 kV; with 0.5 mile traversing a Tier 1 High Fire Threat District and 17.4 miles traversing a Tier 2 High Fire Threat District. Supporting the towers is a series of 515 lattice steel towers and two steel monopoles.

Maintenance. Table 4-95 summarizes maintenance work.

Table 4-95: Power Transmission Lines 3 and 4 Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
Vegetation Inspection and Removal	Completed annually	Vegetation treatment in accordance with the Transmission Vegetation Management Plan
Maintenance	Completed annually	Completed as needed

Note:
PM = preventive maintenance

Condition. Power Transmission Lines 3 and 4 are in only fair condition, and it is anticipated that the lines will need capital investment soon. An updated condition assessment is planned to be completed by late 2025. Additionally, Power Transmission Lines 3 and 4 have 77 sites that require mitigation for hard clearances.

[3] "Hard clearance" is defined as insufficient safety clearance for roads, buildings, other wires, etc.

Power Transmission Lines 5 and 6

Description. Power Transmission Lines 5 and 6 are used to transmit power from the Intake Switchyard to Warnerville Substation. This asset consists of 48.4 miles of two three-phase conductors that transmit power at a voltage of 230 kV; with 22.2 miles traversing a Tier 2 High Fire Threat District and 3.3 miles traversing a Tier 3 High Fire Threat District. Supporting the towers is a series of 513 lattice steel towers and two steel monopoles.

Maintenance. Table 4-96 summarizes maintenance work.

Table 4-96: Power Transmission Lines 5 and 6 Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
Vegetation Inspection and Removal	Completed annually	Vegetation treatment in accordance with the Transmission Vegetation Management Plan
Maintenance	Completed annually	Completed as needed

Note:
PM = preventive maintenance

Condition. Power Transmission Lines 5 and 6 are in good condition and fit for service; however, given the asset's age, an updated condition assessment is planned to be completed by late 2025. Additionally, Power Transmission Lines 5 and 6 have 72 sites that require mitigation for hard clearances.

Power Transmission Lines 7 and 8

Description. Power Transmission Lines 7 and 8 are used to transmit power from Warnerville Substation to MID's Standiford Substation. This asset consists of 12.5 miles of two three-phase conductors that transmit power at a voltage of 115 kV. Supporting the towers is a series of 78 lattice steel towers. This asset is not in a High Fire Threat District.

Maintenance. Table 4-97 summarizes maintenance work.

Table 4-97: Transmission Lines 7 and 8 Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
Vegetation Inspection and Removal	Completed annually	Vegetation treatment in accordance with the Transmission Vegetation Management Plan
Maintenance	Completed annually	Completed as needed

Note:
PM = preventive maintenance

Condition. Power Transmission Lines 7 and 8 are in good condition and fit for service; however, capital investments are required. The existing conductor is inadequate for the impacts caused by

third-party developers connecting to the bulk electric system. Additionally, there are 18 sites that require mitigation for hard clearances.

Power Transmission Lines 9, 10, and 11

Description. Power Transmission Lines 9, 10, and 11 are used to transmit power from Kirkwood Powerhouse to the Intake Switchyard. This asset consists of 1.46 miles of three three-phase conductors that transmit power at a voltage of 230 kV; with 1.4 miles traversing a Tier 2 High Fire Threat District. Supporting the towers are series of four (Lines 9 and 10) and four (Line 11) lattice steel towers.

Maintenance. Table 4-98 summarizes maintenance work.

Table 4-98: Transmission Lines 9, 10, and 11 Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
Vegetation Inspection and Removal	Completed annually	Vegetation treatment in accordance with the Transmission Vegetation Management Plan
Maintenance	Completed annually	Completed as needed

Note:
PM = preventive maintenance

Condition. Power Transmission Lines 9, 10, and 11 are in good condition; however, given its age, an updated condition assessment is recommended during the next reporting cycle. Additionally, there are three sites that require mitigation for hard clearances.

Intake Switchyard

Description. The Intake Switchyard is used to aggregate power generated from both Holm Powerhouse and Kirkwood Powerhouse so it can be transmitted on a single set of transmission lines—Power Transmission Lines 5 and 6. During outages of both Kirkwood Powerhouse and/or Holm Powerhouse, power can be back-fed from Power Transmission Lines 5 and 6 to either powerhouse. Integral to the switchyard is a series of eight SF6 breakers, switches, and a control room, all serving operating and protection functions. The Intake Switchyard is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-99 summarizes maintenance work.

Table 4-99: Intake Switchyard Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Operator site security inspection
Vegetation Control	Completed annually	Vegetation removal
Maintenance	Completed annually	Annual maintenance

Note:
PM = preventive maintenance

Condition. The Intake Switchyard is in good condition and is fit for service. Two of the eight circuit breakers were replaced in 2007 (CBs 310 and 330); the remaining circuit breakers (CBs 300, 320, 340, 350, 360, and 370) were replaced in 2013. All of the breakers are well within their expected useful life. A condition assessment of the equipment in control room is recommended because much of it is original and was installed in the 1960s.

Moccasin Switchyard

Description. Moccasin Switchyard is used to provide protection to Power Transmission Lines 5 and 6 and is also a termination point for Power Transmission Lines 3 and 4. Moccasin Switchyard is adjacent to Moccasin Powerhouse and includes two 115 kV oil circuit breakers (OCBs); two 230 kV OCBs; and ancillary equipment such as two 2.4 kV distribution transformers, one 480 V distribution transformer, two 13.8 kV isolation transformers, bus work, switches, and grounding. Moccasin Switchyard is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-100 summarizes maintenance work.

Table 4-100: Moccasin Switchyard Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Operator site security inspection
Vegetation Control	Completed annually	Vegetation removal
Maintenance	Completed annually	Annual maintenance

Note:
PM = preventive maintenance

Condition. Moccasin Switchyard is in fair condition and fit for service. The equipment in the switchyard is approaching or has exceeded its expected useful life and requires capital investment.

Warnerville Substation

Description. Warnerville Substation serves as a termination point for Power Transmission Lines 5 and 6 and Power Transmission Lines 7 and 8. It is also a critical connection point to the bulk electric system, where HHWP is typically connected to PG&E's power transmission system. Warnerville Substation includes seven SF6 breakers, four OCBs, two auto transformers, multiple switches, and two control rooms. Warnerville Substation is in a non-High Fire Threat District.

Maintenance. Table 4-101 summarizes maintenance work.

Table 4-101: Warnerville Substation Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed weekly	Operator walkthroughs
	Completed monthly	Operator site security inspection
Vegetation Control	Completed annually	Vegetation removal
Maintenance	Completed annually	Annual maintenance

Note:
PM = preventive maintenance

Condition. Warnerville Substation is in fair condition and is fit for service. The autotransformers and the 230 kV OCBs were replaced in 2020; however, the original 115 kV OCBs remain in service and have exceeded their expected useful life. The remaining OCBs are scheduled for replacement and included in the Warnerville Rehabilitation capital project.

Calaveras Substation

Description. The Calaveras Substation is a small substation that serves as a termination point for Power Transmission Lines 3 and 4. The primary function of Calaveras Substation is to serve the power that is required to operate multiple Regional Water facilities, including the SAPS, Chlorination Plant, and Sunol Filter Plant. Calaveras Substation includes a single transformer, as well as other electrical equipment such as breakers and switches. Calaveras Substation is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-102 summarizes maintenance work.

Table 4-102: Calaveras Substation Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed monthly	Operator site security inspection
Vegetation Control	Completed annually	Vegetation control
Maintenance	Completed annually	Annual maintenance

Note:
PM = preventive maintenance

Condition. Calaveras Substation is in good condition; however, due to growing power demands from Regional Water, along with redundancy concerns, capital investment is recommended.

4.7.1.2 Capital Improvements

HHWP currently has four active capital projects on its power transmission assets, representing a total capital investment of $121.1 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of these active large capital projects are provided in the following sections.

Transmission Lines 7 and 8 Upgrades (Approved Budget: $38.0 Million; Substantial Completion 2024)

Scope. The Transmission Lines 7 and 8 Upgrades project includes replacing the conductors to mitigate the impacts of new power flows across the HHWP power transmission system due to power generators that were approved to connect to the grid by the California Independent System Operator. The project's scope also includes multiple tower raises to mitigate the remaining hard clearance issues. At the completion of the project, Transmission Lines 7 and 8 will have new upgraded conductor, with all hard clearance issues resolved.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-103.

Table 4-103: Transmission Lines 7 and 8 Upgrades Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
Design Criteria Report	December 7, 2020
35% Design	February 1, 2021
65% Design	May 14, 2021
95% Design	September 24, 2021
Environmental Phase Complete	November 15, 2021
Issued for Construction Design	January 18, 2022
Contract Advertisement	February 11, 2022
Bid Opening	March 24, 2022
Bid Award	June 28, 2022

Warnerville Substation Rehabilitation (Approved Budget: $34.2 Million; Substantial Completion: 2025)

Scope. The scope of this project includes replacement of (1) three existing three-phase autotransformers (with ratings of 150 MVA, 75 MVA, and 75 MVA) with two new 300 MVA autotransformers; (2) seven existing 230 kV OCBs with seven new SF6 breakers; and (3) five existing 115 kV OCBs with four new SF6 breakers. Additionally, the project includes building a new control building and replacing aged components such as buss bars, surge arresters,

disconnect switches, voltage transformers, capacitive voltage transformers, protection and control relays, yard grounding, fencing, and grading.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-104.

Table 4-104: Warnerville Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
65% design of a contingency plan for an oil circuit breaker failure	April 22, 2021
95% design of a contingency plan for an oil circuit breaker failure	June 30, 2021
95% design of a contingency plan for an oil circuit breaker failure	August 2021
100% design of a contingency plan for an oil circuit breaker failure	January 2022
Electrical Professional Service Contract PRO.0182 Notice to Proceed	September 2021
Phase 2 Design Task Order Notice to Proceed	May 2022

Moccasin Switchyard Rehabilitation (Approved Budget: $9.7 Million; Substantial Completion: 2028)

Scope. The project will involve rehabilitating Moccasin Switchyard by replacing the 115 kV disconnect switches, 115 kV bus work, 230 kV disconnect switches, 230 kV bus work, 115 kV and 230 kV OCBs, and surge arrestors; and performing an analysis of the existing grounding system.

Milestones Completed During the Reporting Cycle. There were no milestones achieved during this reporting cycle. The Moccasin Switchyard Rehabilitation Project is scheduled to kick off in 2022.

Calaveras Substation Upgrades (Approved Budget: $39.2 Million)

Scope. The project will involve providing upgrades related to the Calaveras Substation and the electrical poles to and from the substation along Calaveras Road.

Milestones Completed During the Reporting Cycle. There were no milestones achieved during this reporting cycle. The Calaveras Substation Upgrades Project is scheduled to kick off in 2025.

Summary of Levels of Service Impacts

LOSs that are supported by the power transmission system capital improvements are provided in Table 4-105.

Table 4-105: Power Transmission Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Transmission Lines 7 and 8 Upgrades			✓			✓		✓
Warnerville Substation Rehabilitation			✓			✓		✓
Moccasin Switchyard Rehabilitation			✓			✓		✓
Calaveras Substation Upgrades			✓			✓		✓

4.8 Power Distribution Assets

SFPUC owns and operates multiple power distribution assets, including pole-mounted transformers, switches, reclosures, and conductors. Most of these assets are within the Hetch Hetchy Water system and traverse Tier 2 and 3 High Fire Threat Districts.

4.8.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of multiple power distribution assets. These assets include:

Holm Powerhouse to Cherry (HP-CH)
Cherry Dam to Cherry Valve House (CD-CV)
Kirkwood Powerhouse to O'Shaughnessy (KP-OS)
Mather to Cafeteria (MA-CA)
Mather to Evergreen (MA-EV)
Moccasin Powerhouse to Low Head (MP-LH)
Moccasin Powerhouse to Sewer Treatment Plant (MP-ST)
O'Shaughnessy to O'Shaughnessy Compound (OS-OC)

4.8.1.1 Asset Descriptions, Maintenance, and Condition

Asset descriptions, maintenance, and conditions for HHWP power distribution assets are provided in the following sections. In addition to annual equipment inspections, HHWP also performs (1) detailed inspections on all distribution poles every 5 years; and (2) distribution pole intrusive/integrity testing on all poles every 10 years.

Holm Powerhouse to Cherry (HP-CH)

Description. The HP-CH line distributes power from Holm Powerhouse to the Cherry Lake Compound and consists of 9.5 miles of 22 kV overhead conductors in the Stanislaus National Forest. The line also includes one 13.8 kV to 22 kV transformer at Holm Powerhouse. The HPH-CH lines are in a Tier 2 High Fire Threat District (HFTD).

Maintenance. Table 4-106 summarizes maintenance work.

Table 4-106: Holm Powerhouse to Cherry Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping, and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance
	Completed annually	Herbicide application on Granite Portal Line

Note:
PM = preventive maintenance

Condition. The HP-CH distribution line is in good condition. Most of this distribution line was replaced in 2013 after the Rim Fire. The line is fit for service; however, other improvements are required.

Cherry Dam to Cherry Valve House (CD-CV)

Description. The CD-CV line is a 1.3-mile branch off the HP-CH line and comprises overhead and underground conductors,. both operating at 22 kV. The overhead segment is approximately 0.6 mile, distributing power to the Cherry Valve House at the base of Cherry Lake Dam. The remaining 0.76 mile is underground and supplies 22 kV power to the Cherry–Eleanor Pumps and Cherry-Eleanor Pump Station, all in the Stanislaus National Forest. The CD-CV line is in a Tier 2 HFTD.

Maintenance. Table 4-107 summarizes maintenance work.

Table 4-107: Cherry Dam to Cherry Valve House Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. The CD-CV distribution line is in good condition. The line is fit for service; however, other improvements are required.

Kirkwood Powerhouse to O'Shaughnessy (KP-OS)

Description. The KP-OS line is a 22 kV overhead distribution line that begins at Kirkwood Powerhouse, in the Stanislaus National Forest. It provides power to HHWP facilities at Hetch

Hetchy Reservoir in Yosemite National Park. The KP-OS line spans approximately 17.4 overhead conductor miles through a Tier 2 High Fire Threat District.

Maintenance. Table 4-108 summarizes maintenance work.

Table 4-108: Kirkwood Powerhouse to O'Shaughnessy Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	October 2020	10-year distribution pole intrusive/integrity testing (portion of KP-OS segment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance
	Completed annually	Herbicide application on Intake Camp Line

Note:
KP-OS = Kirkwood Powerhouse to O'Shaughnessy
PM = preventive maintenance

Condition. The KP-OS distribution line is in good condition, having been mostly replaced in 2013 after the Rim Fire. The line is fit for service; however, other improvements are required.

Mather to Cafeteria (MA-CA)

Description. The MA-CA line is a 2.4 kV overhead line that branches off the 22 kV KP-OS line. The MA-CA line is in the Stanislaus National Forest and feeds the Camp Mather Cafeteria building. The MA-CA line consists of approximately 0.6 mile of overhead conductor and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-109 summarizes maintenance work.

Table 4-109: Mather to Cafeteria Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. The MA-CA distribution line is fit for service; however, the line is in need of upgrades and repairs, which are scheduled to take place in the fall of 2022.

Mather to Evergreen (MA-EV)

Description. The MA-EV line is a 2.4 kV overhead line that branches off the 22 kV KP-OS line. The MA-EV line is in the Stanislaus National Forest. It feeds power to the Evergreen Lodge, a privately owned facility adjacent to Camp Mather. The MA-EV line consists of approximately 0.9 mile of overhead conductor and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-110 summarizes maintenance work.

Condition. The MA-EV distribution line is in good condition. The line is fit for service; however, other improvements are required.

Table 4-110: Mather to Evergreen Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Moccasin Powerhouse to Low Head (MP-LH)

Description. The MP-LH overhead line distributes power from Moccasin Powerhouse to the Moccasin Low Head Powerhouse via the Moccasin Switchyard 13.8 kV cabinet. It provides 2.4 kV power distribution to the upper cottages in Moccasin camp, Moccasin UV building, Moccasin maintenance shops, the Moccasin peak radio tower, Moccasin spray fields, Priest Reservoir gate house, Priest butterfly valves, West Portal cottage, Priest cottage, and the California Department of Fish and Wildlife Fish Hatchery and residences. The MP-LH line consists of approximately 7.4 miles of overhead conductor and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-111 summarizes maintenance work.

Table 4-111: Moccasin Powerhouse to Low Head Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	March 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. The MP-LH distribution line is in good condition. The line is fit for service; however, other improvements are required.

Moccasin Powerhouse to Sewer Treatment Plant (MP-ST)

Description. The MP-ST line is a 2.4 kV overhead line in the town of Moccasin, Tuolumne County. It provides 120/240 V power to Moccasin cottages 1-18, Engineering, Records, Energy Services, and the Moccasin Administration Building. Underground segments provide the power to light poles around the Moccasin Reservoir and Administration. The MP-ST line consists of approximately 1.5 miles of overhead conductor, and the underground portion length is unknown. The MP-ST line is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-112 summarizes maintenance work.

Condition. The MP-ST distribution line is in good condition. The line is fit for service; however, other improvements are required.

Table 4-112: Moccasin Powerhouse to Sewer Treatment Plant Preventive Maintenance Summary
(July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	March 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

O'Shaughnessy to O'Shaughnessy Compound (OS-OC)

Description. The OS-OC line is a 2.4 kV line off the 22 kV KP-OS line in Yosemite National Park. It provides overhead power to the O'Shaughnessy Cottages 1, 2, 3, and 4, NPS buildings, chlorination building, UV building, and water tanks. The underground portion provides power to O'Shaughnessy Chalet, the sewer pump station, emergency generators, lift station pumps, and O'Shaughnessy Dam Gallery 1. The OS-OC line consists of approximately 0.5 mile of overhead conductor, with 0.1 mile underground, and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-113 summarizes maintenance work.

Condition. The OS-OC line is in good condition. The line is fit for service; however, other improvements are required.

Table 4-113: O'Shaughnessy to O'Shaughnessy Compound Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Aerial inspection by helicopter (vegetation and equipment)
	April 2022	Pole 4292 compliance inventory confirmation, mapping and new PM work orders
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

4.8.1.2 Capital Improvements

Capital improvements to the Power Distribution system are defined in the HHWP's R&R Program.

4.8.2 Regional Water

WSTD is responsible for O&M of multiple power distribution assets. These assets include:

Calaveras Dam Power Pole Line (CDL)
Calaveras Substation Power Pole Line (CSL)
Crystal Springs Power Pole Line (CYL)
Pilarcitos Power Pole Line (PPL)
Pulgas Power Pole Line (PUL)
San Andreas Lake Power Pole Line (SAL)
Sawyer Camp Power Pole Line (SCL)
Sunol Water Temple Power Pole Line (STL)

4.8.2.1 Asset Descriptions, Maintenance, and Condition

Asset descriptions, maintenance, and condition for WSTD power distribution assets are provided in the following sections. In addition to annual equipment inspections, WSTD performs (1) detailed inspections on all distribution poles every 5 years; and (2) distribution pole intrusive/ integrity testing on all poles every 10 years.

Calaveras Dam Power Pole Line (CDL)

Description. CDL is a 120/240 V overhead distribution line in Alameda County that provides power to the Calaveras Dam Adit and the Calaveras Reservoir watershed keepers cottage. CDL is approximately 0.1 overhead mile long and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-114 summarizes maintenance work.

Condition. CDL is in fair condition. The line is fit for service; however, other improvements are being evaluated.

Table 4-114: Calaveras Dam Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	December 2020	5-year detailed inspections on all distribution poles
	December 2020	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Calaveras Substation Power Pole Line (CSL)

Description. CSL is a 21.6 kV overhead distribution line in Alameda County that provides power to SVWTP, SAPS, Sunol Valley Chloramines facility, the AEP Station, and the AWP Station. CSL is approximately 3.8 overhead miles in length and is in a Tier 2 High Fire Threat District.

Maintenance. Table 4-115 summarizes maintenance work.

Table 4-115: Calaveras Substation Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	December 2020	5-year detailed inspections on all distribution poles
	December 2020	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance
	Completed annually	Hot washing of contaminated insulators (due to quarry activities)

Note:
PM = preventive maintenance

Condition. CSL is in good condition. The line is fit for service; however, other improvements are being evaluated.

Crystal Springs Power Pole Line (CYL)

Description. CYL is a 2.7 kV overhead distribution line in San Mateo County. CYL provides power to the Crystal Springs watershed keeper's cottage and the reservoir entrance gates. CYL is 0.7 overhead mile in length and is within a Tier 2 High Fire Threat District.

Maintenance. Table 4-116 summarizes maintenance work.

Table 4-116: Crystal Springs Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	February 2022	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. CYL is in good condition. The line is fit for service; however, other improvements are being evaluated.

Pilarcitos Power Pole Line (PPL)

Description. PPL is a 4.16 kV overhead distribution line in San Mateo County. PPL provides power to the Davis Tunnel watershed keeper's cottage, the Pilarcitos watershed keeper's cottage, and the forebay metering and gate valves on the Pilarcitos Dam. PPL is 9.5 overhead miles in length and is in a Tier 3 High Fire Threat District.

Maintenance. Table 4-117 summarizes maintenance work.

Table* 4-117*: Pilarcitos Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	November 2021	5-year detailed inspections on all distribution poles
	November 2021	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. PPL is in fair condition. The line is fit for service; however, other improvements are being evaluated.

Pulgas Power Pole Line (PUL)

Description. The PUL is a 4.16 kV overhead distribution line in San Mateo County. PUL provides power to the Pulgas Valve Lot and small water quality sampling stations in the valve lot. PUL is approximately 0.6 overhead line mile long and in a Tier 2 High Fire Threat District.

Maintenance. Table 4-118 summarizes maintenance work.

Table 4-118: Pulgas Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. PUL is in fair condition. The line is fit for service; however, other improvements are being evaluated.

San Andreas Lake Power Pole Line (SAL)

Description. SAL is a 4.16 kV overhead distribution line in San Mateo County. SAL provides power to the North San Andreas watershed keeper's cottage and is approximately 0.6 overhead mile long. This line is in a Tier 3 High Fire Threat District.

Maintenance. Table 4-119 summarizes maintenance work.

Table 4-119: San Andreas Lake Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. SAL is in fair condition. The line is fit for service; however, other improvements are being evaluated.

Sawyer Camp Power Pole Line (SCL)

Description. SCL is a 4.16 kV overhead distribution line in San Mateo County. SCL provides power to the Sawyer Camp watershed keeper's cottage and a small storage facility near Sawyer Camp Lake. SCL is approximately 0.5 overhead line mile in length and is in a Tier 3 High Fire Threat District.

Maintenance. Table 4-120 summarizes maintenance work.

Condition. SCL is in fair condition. The line is fit for service; however, other improvements are being evaluated.

Table 4-120: Sawyer Camp Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	June 2022	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Sunol Water Temple Power Pole Line (STL)

Description. STL is a 480 V overhead distribution line in Alameda County. STL provides power to the Sunol Water Temple and smaller facilities surrounding it. STL is approximately 0.1 overhead mile long and in a Tier 2 High Fire Threat District.

Maintenance. Table 4-121 summarizes maintenance work.

Table 4-121: Sunol Water Temple Power Pole Line Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Visual ground inspection of equipment
	July 2021	5-year detailed inspections on all distribution poles
	July 2021	10-year distribution pole intrusive/integrity testing
Maintenance	Completed annually	Pole 4292 vegetation clearance

Note:
PM = preventive maintenance

Condition. STL is in good condition. The line is fit for service; however, other improvements are being evaluated.

4.8.2.2 Capital Improvements

Currently, there are no capital projects planned for these assets.

4.9 Watersheds, Roads, and Bridges

To access RWS facilities, SFPUC maintains various roads and bridges across the region. SFPUC also maintains and manages watersheds that feed their Bay Area reservoirs. The responsibility for O&M of these assets is divided geographically between both HHWP and NRLMD. A map of the SFPUC watersheds is included as Appendix D.

4.9.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of a series of roads and bridges along its system, including almost 40 miles of paved roads, 12 bridges, and an unknown number of miles of unpaved access roads. Many of the roads and bridges are also used by USFS and NPS personnel to access federal assets and resources. Additionally, these assets are used by the public to access the Stanislaus National Forest and Yosemite National Park.

4.9.1.1 Asset Descriptions, Maintenance, and Condition

Cherry Lake Road

Description. Cherry Lake Road is a 23.5-mile-long paved road that extends from Highway 120, east of Groveland, to Lake Lloyd (aka Cherry Lake). Cherry Lake Road was formerly referred to as Cherry Oil Road.

Maintenance. Table 4-122 summarizes maintenance work.

Table 4-122: Cherry Lake Road Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Maintenance	Completed annually	Clean ditches and grade right-of-way roads
	Completed annually	Road improvements and paving
	Completed seasonally	Culvert cleaning
	Completed seasonally	Snow removal

Note:
PM = preventive maintenance

Condition. Cherry Lake Road is in good condition and is fit for service. Portions of the road surface were patched and chip-sealed, and roadside drainage culverts were cleared during the reporting cycle.

Hetch Hetchy Road

Description. Hetch Hetchy Road is a 17-mile-long paved road. It extends from Cherry Lake Road (at approximate mile post 5) to O'Shaughnessy Dam and Hetch Hetchy Reservoir and has uses similar to those of Cherry Lake Road; however, it also serves as a redundant route to Camp Mather.

Maintenance. Table 4-123 summarizes maintenance work.

Condition. Hetch Hetchy Road is in good condition and is fit for service. Portions of the road surface were patched and chip-sealed, and roadside drainage culverts were cleared during the reporting cycle.

Table 4-123: Hetch Hetchy Road Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Maintenance	Completed annually	Clean ditches and grade right-of-way roads
	Completed annually	Road improvements and paving
	Completed seasonally	Culvert cleaning
	Completed seasonally	Snow removal

Note:
PM = preventive maintenance

O'Shaughnessy Adit Access Bridge

Description. The O'Shaughnessy Adit Access Bridge (aka the Hetchy Adit Bridge) is a four-span, simply supported bridge with timber stringers and deck, and reinforced concrete piers. The bridge has a total length of 136 feet, spanning the Tuolumne River, and is downstream of O'Shaughnessy Dam. The primary function of the bridge is to provide access to Canyon Tunnel's Hetchy Adit.

Maintenance. Table 4-124 summarizes maintenance work.

Table 4-124: O'Shaughnessy Adit Access Bridge Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Maintenance	Completed annually	Cleaning and inspection of bridge

Note:
PM = preventive maintenance

Condition. O'Shaughnessy Adit Access Bridge is in fair condition and is currently meeting access needs. However, access to the Hetchy Adit for the upcoming bulkhead construction project requires increased loading on O'Shaughnessy Adit Access Bridge; improvements are being planned.

Cherry Lake Road Bridge at Early Intake

Description. The Cherry Lake Road Bridge at Early Intake (aka Early Intake Bridge) is a two-span, simply supported bridge with rolled steel beams, timber deck, and reinforced concrete piers. The bridge has a total length of 24 feet, spanning the Tuolumne River, and is downstream of Early Intake Dam. The primary function of the bridge is to provide access to multiple critical assets in the Stanislaus National Forest.

Maintenance. Table 4-125 summarizes maintenance work.

Table 4-125: Cherry Lake Road Bridge at Early Intake Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Bridge inspection
Maintenance	Completed annually	Intake wooden bridge cleaning

Note:
PM = preventive maintenance

Condition. Cherry Lake Road Bridge at Early Intake is in fair condition and is fit for service for some activities. However, weight limitations have impacted HHWP's operations at times.

Cherry Lake Road Bridge at Cherry Creek

Description. The Cherry Lake Road Bridge at Cherry Creek (aka Cherry Creek Bridge) is a three-span, continuous bridge with steel beams, reinforced concrete deck, steel bents, and reinforced concrete piers. The bridge has a total length of 27 feet, spanning Cherry Creek, and is upstream of Holm Powerhouse. The primary function of the bridge is to provide continuity of Cherry Lake Road over Cherry Creek, establishing access to multiple water and power assets in the Stanislaus National Forest.

Maintenance. Table 4-126 summarizes maintenance work.

Table 4-126: Cherry Lake Road Bridge at Cherry Creek Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Bridge inspection

Note:
PM = preventive maintenance

Condition. Cherry Lake Road Bridge at Cherry Creek is in fair condition and is fit for service.

Holm Access Bridge

Description. The Holm Access Bridge (aka Holm Intake Bridge) is a three-span, continuous bridge with reinforced concrete beams, deck, and piers. The bridge has a total length of 136 feet, spanning Cherry Creek, and is downstream of Holm Powerhouse. The primary function of the bridge is to provide access to Holm Powerhouse.

Maintenance. Table 4-127 summarizes maintenance work.

Table 4-127: Holm Access Bridge Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed annually	Bridge inspection for Holm Powerhouse Bridge
	Completed annually	Bridge inspection for Holm Powerhouse Bridge Vegetation

Note:
PM = preventive maintenance

Condition. Holm Access Bridge is in fair condition and is fit for service.

South Fork Siphon Access Bridge

Description. The South Fork Siphon Access Bridge (aka South Fork Bridge) is a single-span, welded truss bridge with reinforced concrete deck and abutments. The bridge has a total length of 220 feet, spanning the Middle Fork of the Tuolumne River, and is north of Highway 120 near its intersection with Cherry Lake Road. The primary function of the bridge is to provide access to Mountain Tunnel's South Fork Siphon.

Maintenance. No PM was required or completed during this period.

Condition. South Fork Siphon Access Bridge is in good condition and is fit for service.

Cherry Lake Road Bridge at Middle Fork

Description. The Cherry Lake Road Bridge at Middle Fork (aka Middle Fork Bridge) is a three-span bridge with a pre-stressed box girder main span, reinforced concrete slabs for the remaining spans, and reinforced concrete piers and abutments. The bridge has a total length of 102 feet, spanning the Middle Fork of the Tuolumne River, and is north of South Fork Yard, near the intersection of Cherry Lake Road and Highway 120. The primary function of the bridge is to provide access to multiple water and power assets in the Stanislaus National Forest.

Maintenance. No PM was required or completed during this period.

Condition. Cherry Lake Road Bridge at Middle Fork is in good condition and is fit for service.

Moccasin Creek Debris Deflector Bridge

Description. The Moccasin Creek Debris Deflector Bridge (aka Moccasin Creek Bridge) is an eight-span, continuous bridge with timber stringers and deck, steel piers, and reinforced concrete abutments. The bridge has a total length of 136 feet, spanning Rattlesnake Creek, and is upstream of Moccasin Reservoir. The primary function of the bridge is to serve as a debris barrier to help keep debris from entering the Moccasin Diversion Pipe during medium- and high-flow events.

Maintenance. Table 4-128 summarizes maintenance work.

Table 4-128: Moccasin Creek Debris Deflector Bridge Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Inspection	Completed bi-annually	Inspect for debris

Note:
PM = preventive maintenance

Condition. The Moccasin Creek Debris Deflector Bridge is in good condition and is fit for service. The bridge deck timber and guardrails were replaced in 2021/2022.

California Aqueduct Bridges 1 and 2

Description. The California Aqueduct Bridges 1 and 2 (aka Hetch Hetchy Maintenance Bridges 1 and 2) are both two-span, continuous bridges with reinforced concrete beams, decks, and piers. The bridges each have a length of 144.5 feet, spanning the California Aqueduct in the Central Valley. The primary function of the bridge is to provide access for HHWP personnel performing O&M activities along the SJPLs and power transmission system.

Maintenance. No PM was required or completed during this period.

Condition. The California Aqueduct Bridges are in serviceable condition. The bridge railings were replaced in 2021; this was the only corrective action recommended in the condition assessment.

Oakdale Irrigation District Bridges 1 and 2

Description. The Oakdale Irrigation District Bridges 1 and 2 (aka OID 1 and OID 2) are single-span bridges with rolled steel beams, timber decks, and reinforced concrete abutments. OID 1 has an overall length of 102 feet, spanning the Brichetto Lateral Canal; OID 2 has an overall length of 83.5 feet, spanning the Claribel Lateral Canal. The primary function of the bridges is to provide access for HHWP personnel performing O&M activities along the SJPLs and power transmission system.

Maintenance. No PM was required or completed during this period.

Condition. The surface deck of California Aqueduct Bridge 1 needs to be replaced but is currently meeting access needs; repairs are being planned. California Aqueduct Bridge 2 is in serviceable condition, with no planned repairs.

4.9.1.2 Capital Improvements

HHWP currently has two active capital projects on its watershed, roads, and bridges assets, representing a total capital investment of $41.1 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of these active large capital projects are provided in the following sections.

Holm Bridge Rehabilitation (Approved Budget: $11.7 Million; Substantial Completion: 2036)

Scope. The project will involve replacing the 136-foot, three-span, continuously supported bridge over Cherry Creek that provides the only access to Holm Powerhouse. Bridge replacement will

address seismic and current Caltrans design standard deficiencies (e.g., T-beam steams, end diaphragms, and lateral struts).

Milestones Completed During the Reporting Cycle. There were no milestones achieved during this reporting cycle. The Holm Bridge Rehabilitation Project is scheduled to kick off in 2030.

Bridge Replacement (Four Bridges) (Approved Budget: $29.4; Substantial Completion: 2027)

Scope. The project will involve providing rehabilitation and/or replacement of the O'Shaughnessy Adit Access Bridge and the Lake Eleanor Dam Bridge.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in the Table 4-129.

Table 4-129: Bridge Replacement (Four Bridges) Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
Issued Notice to Proceed under PRO-0085.B for surveying, geotechnical investigation, and hydraulic analysis for O'Shaughnessy Adit Access Bridge	October 2020
Completed topographic survey and seismic refraction study for O'Shaughnessy Adit Access Bridge	May 2021
Completed geotechnical evaluation and geotechnical data report for O'Shaughnessy Adit Access Bridge	October 2021
Completed Geotechnical Data Report (Final) for O'Shaughnessy Adit Access Bridge	December 2021

Summary of Levels of Service Impacts

LOSs that are supported by the watershed, roads, and bridges capital improvements are provided in Table 4-130.

Table 4-130: Watershed, Roads, and Bridges – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Holm Bridge Rehabilitation			✓					
Bridge Replacement (four Bridges)			✓					

4.9.2 Regional Water

NRLMD is responsible for the O&M of the SFPUC Alameda and Peninsula watersheds, including the roads, fences, fuel breaks, and culverts in those watersheds. PM activities for these assets are

determined and scheduled by NRLMD. The maintenance is performed by other WE divisions, contractors overseen by NRLM staff, or NRLM staff themselves. Some of these assets are in Maximo, but many are not. Work being performed in the watershed includes:

- Maintenance of the watersheds:
  - Ingress/egress, including gates, locks, and fencing
  - Vegetation management for roadside clearance, fuels management, hazard tree removal, and invasive species control
  - Maintenance of rangeland management infrastructure, including solar groundwater pumps, troughs, piping, and spring boxes
  - Maintenance and monitoring of the Bioregional Habitat Restoration mitigation sites

- Maintenance of roads and culverts:
  - Grading, rocking, and/or repaving roads
  - Clearing roadside ditches or drainage ditches of seasonal debris
  - Cleaning and repairing culvert inlet and outlet structures
  - Culvert repair, replacement, and installation

- Maintenance of the transmission pipeline ROWs:
  - Vegetation management for state weed abatement compliance, fuels management, and hazard tree removal
  - Removal of trash, debris, and other materials for health and safety and code compliance

4.9.2.1 Capital Improvements

Regional Water currently has eight active capital projects on its watershed, roads, and bridges assets, representing a total capital investment of $21.5 million. Regional Water also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of the active large capital projects are provided in the following sections.

East Bay Regional Park District Water System (Approved Budget:$5.5 Million; Substantial Completion: 2022)

Scope. As a mitigation for the Calaveras Dam Replacement Project (CDRP), SFPUC agreed to construct new potable water distribution facilities for the Sunol Regional Wilderness Park (SRP), managed by the East Bay Regional Park District (EBRPD). The project purpose is to provide a reliable water supply for potable use at the EBRPD facilities and to provide potable uses at the SRP. Project work includes (1) modification of the existing High Valley water system; (2) installation of new High Valley pipeline and appurtenances; (3) modification of the existing headquarters water system; (4) installation of a new fire suppression system; (5) installation of a new control system; (6) replacement and installation of new solar panels; (7) micro-surfacing of Geary Road from the entrance park sign to the entrance of the Ohlone Bridge; (8) pavement and site restoration along locations where the project requires trench excavation; (9) setup of wildlife exclusion fencing and environmental mitigation/monitoring; and (10) site restoration, including hydroseeding, hiking trail, asphalt pavement, grading, and fences.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-131.

Table 4-131: EBRPD Water System Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Environmental Approval	November 5, 2020
Construction Notice to Proceed	May 10, 2021
Substantial Completion	January 21, 2022

Sneath Lane Gate/San Andreas (Approved Budget: $6.7 Million; Substantial Completion: 2026)

Scope. The 2001 Peninsula Watershed Management Plan identified the need for a new trail connection between San Mateo County's Crystal Springs Regional Trail (North San Andreas) to Golden Gate National Recreation Area's (GGNRA) Sweeney Ridge property at the Sneath Lane Gate. The project includes construction of a multi-modal, 6-foot-wide trail that would be approximately 1.25 miles long and would include a new trailhead, south of GGNRA's parking lot at the end of Sneath Lane in Pacifica. The project will include the following related construction tasks: (1) tree removal; (2) installation of wildlife-friendly security fencing; (3) grading and drainage work; (4) paving of one trailhead parking areas with educational signage; (5) protection of sensitive habitat; and (6) site/vegetation restoration.

This project is an example of investing in watershed management compatible with protecting the watershed lands and providing an opportunity to educate the public about the SFPUC water system and watershed land management.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in Table 4-132.

Table 4-132: Sneath Lane Gate/San Andreas Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Conceptual Engineering Report	January 31, 2022

Southern Skyline Blvd Ridge Trail Extension (Approved Budget: $25.3 Million; Substantial Completion: 2022)

Scope. South of Highway 92, this proposed project would construct a 6-mile-long trail on the Peninsula Watershed in San Mateo County between Highway 92 and the Golden Gate National Recreation Area's (GGNRA) Phleger Estate. The project consists of (1) a 6-foot-wide, all-weather surface trail; (2) retaining structures to stabilize cut and/or fill slopes; (3) drainage facilities; (4) a 15,000-square-foot parking lot accommodating as many as 14 cars; and (5) two pre-fabricated restrooms along the trail; (6) site security features; and (7) landscape restoration.

North of Highway 92, the project includes construction of (1) a trail segment adjacent to the Fifield Cahill Trail that is compliant with the Americans with Disabilities Act; (2) a 16,000-square foot parking lot; and (3) one prefabricated restroom.

In addition, the project includes the following construction and construction-related work: (1) removal of 160 trees; (2) installation of 9.3 miles of wildlife-friendly security fencing;

(3) grading and drainage work; (3) installation of 2,000-linear-foot soldier pile retaining walls; (4) paving of two trailhead parking areas with educational signage; (5) protection of sensitive habitat; (6) traffic control; and (7) site/vegetation restoration.

This project is an example of investing in watershed management compatible with protecting the watershed lands and providing an opportunity to educate the public about the SFPUC water system and watershed land management.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-133.

Table 4-133: Southern Skyline Boulevard Ridge Trail Extension Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
NEPA Permit Approval	May 11, 2021
Bid Advertisement	March 30, 2022

Note:
NEPA = National Environmental Policy Act

SA-1 Service Road/Ingoing Road (Approved Budget: $15.8 Million; Substantial Completion: 2025)

Scope. SFPUC has identified landslide and erosion damage that has destabilized service roads (East Shore Service Road and West Shore Service Road) and adjacent areas in three locations on Peninsula Watershed lands along the San Andreas Reservoir in San Mateo County. Recommendations for the short-term and long-term repairs of the roads are being evaluated. Construction constraints that have been identified include dewatering the San Andreas Reservoir to 441 feet; and avoiding construction activities in the months of January to March, due to Hetch Hetchy shutdown. Depending on the findings, the potential scope of work specific to these three locations includes (1) construction of shoreline riprap north of the eastern shore service road (approximately 770 feet); (2) re-alignment of the roadway (approximately 350 feet) and construction of shoreline riprap (approximately 400 feet) at the eastern shore service road; (3) construction of a pile wall (approximately 550 feet) and shoreline riprap (approximately 550 feet) at the western shore service road; and (4) installation of a debris boom.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-134.

Table 4-134: SA-1 Service Road/Ingoing Road Project Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
AAR	April 2021
Conceptual Engineering Report	February 2022

Note:
AAR = Alternatives Analysis Report

Watershed and ROW Protection – Land Acquisition

The Watershed and Environmental Improvement Program (WEIP) includes the comprehensive identification and protection of critical watershed lands and ecosystem restoration needs within the hydrologic boundaries of the Alameda Creek, Peninsula (San Mateo and Pilarcitos Creeks), and Tuolumne River watersheds; and prioritizes the protection and/or restoration of these lands. Projects under this program will protect source water quality; protect native species and their habitat; and identify critical watershed lands for protection by purchasing fee title and/or perpetual conservation easements from willing landowners. Initial funding for this program came from WSIP bond funds ($20 million); now that these funds have been expended, funding will come from CIP bond funds. The first project funded from this program was approved by SFPUC in December 2021 to acquire approximately 653 acres of primary Alameda Watershed lands in Alameda and Santa Clara counties. This project is now complete, and a second project of similar scale, also in the Alameda Watershed, is in the appraisal process and expected to be considered by SFPUC in early 2023.

Summary of Levels of Service Impacts

LOSs that are supported by the RWS watershed, roads, and bridges capital improvements are provided in Table 4-135.

Table 4-135: RWS Watershed, Roads, and Bridges Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
EBRPD Water System			✓					
Sneath Lane Gate/San Andreas							✓	✓
Southern Skyline Blvd Ridge Trail Extension							✓	✓
SA-1 Service Road/ Ingoing Road			✓					✓
Watershed and ROW Protection – Land Acquisition	✓						✓	✓

Note:

EBRPD = East Bay Regional Park District
ROW = right-of-way
RWS = Regional Water System

4.10 Wastewater Treatment Assets

4.10.1 Hetch Hetchy Water

HHWP is responsible for the maintenance and operation of small wastewater systems that serve its buildings and ground assets at multiple upcountry locations. These wastewater systems include:

O'Shaughnessy Wastewater System *Moccasin Wastewater System*
Early Intake Wastewater System

4.10.1.1 Asset Descriptions, Maintenance, and Condition

O'Shaughnessy Wastewater System

Description. The sewage system leading to the lift station is made up of iron pipe coming from the cottages and gravity, feeding a main sewer line running along O'Shaughnessy Camp Road. At the lift station, the main sewer pipe feeds a grinder to ensure that only solids are deposited into the wet well sewage tank. In the lift station, pumps maintain proper levels in the sewage tank through float switches and a control panel. The station pumps transfer sewage from the wet well to the main septic tanks on the opposite end of O'Shaughnessy Camp next to the restrooms near the exit loop. These septic tanks also handle sewage from nearby restrooms. Effluent from these septic tanks continues to a final holding tank fitted with an automatic syphon device to regulate discharge. When the tank drains, effluent is sent down to the 36,000-square-foot spray/leach field. O'Shaughnessy Camp benefits from having both a spray field and leach field system for best absorption of effluent in all climates.

Maintenance. Table 4-136 summarizes maintenance work.

Table 4-136: O'Shaughnessy Wastewater System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Wastewater Sampling	N/A	Sampling of wastewater not required under current permit
Inspection	Completed daily	Facility inspected by Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Audible alarm system on site
	Completed daily	Plant visually monitored for proper operation of equipment and treatment processes
	Completed annually	Effluent flows and operational data reported by Stationary Engineering Crew.

Notes:
PM = preventive maintenance
N/A = not applicable

Condition. A condition assessment was completed, and the O'Shaughnessy lift station is scheduled for replacement. Additionally, the spray field is not operational.

Early Intake Wastewater System

Description. The Early Intake facility consists of the Kirkwood Powerhouse and its related O&M complex. Wastewater is generated from domestic uses of the various residential and facility-related structures, including seven cottages, a bunkhouse, a dining hall, offices, a pool, bathrooms, and a switchyard bathroom. The Kirkwood Powerhouse generates industrial wastewater consisting of water that seeps into the powerhouse and general operations. This water

is collected by a drainage and sump system, incorporating an oil/water separator system to remove potential food grade grease and oil. The wastewater system collects and transports wastewater to the established leachfield west of the switchyard, using sewers, pipes, pumps, and lift stations. To prevent breakage during potential flood events, the sewer line crosses the Tuolumne River through a double contained line that is securely attached to the decking and framework of the vehicular bridge that crosses the river. The engineered leachfield contains 16 observation wells that are systematically spaced to monitor the wastewater levels.

Maintenance. Table 4-137 summarizes maintenance work.

Table 4-137: Early Intake Wastewater System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Wastewater Sampling	Completed quarterly	Sample plant effluent for suspended solids, biology, and chemistry
Inspection	Completed daily	Facility inspected by Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via SCADA alarms
	Completed quarterly	Effluent flows and operational data reported by Stationary Engineering Crew.

Notes:

PM = preventive maintenance
SCADA = supervisory control and data acquisition

Condition. The Early Intake wastewater system is operational; however, due to its age, a condition assessment is recommended to determine whether capital investments are needed.

Moccasin Wastewater System

Description. The Moccasin Sewage Treatment Plant (MSTP) consists of an extended aeration package plant, with disposal by means of spray irrigation and periodic sludge removal. The MSTP collection system consists of approximately 1 mile of sewer main line and various laterals to structures receiving wastewater service. The collection system operates primarily under gravity, with a lift station providing final delivery. Wastewater originates from a complex of residences, a maintenance complex, small water quality laboratory, and administrative offices. Flows to the MSTP typically range between 5,000 gallons and 20,000 gallons per day. There are three monitoring wells (M-1, M-2B, and M-3) installed around the effluent pond; they are purged and sampled on a quarterly basis to monitor potential groundwater impacts from MSTP operations.

Maintenance. Table 4-138 summarizes maintenance work.

Condition. A condition assessment was completed, and a capital project was approved to replace MSTP.

Table 4-138: Moccasin Wastewater System Preventive Maintenance Summary (July 1, 2020, through June 30, 2022)

Name of PM	Completion Date(s)	Description
Wastewater Sampling	Completed biweekly	Sample plant effluent for dissolved and suspended solids and chemistry
Inspection	Completed daily	Facility inspected by Stationary Engineer
Surveillance and Monitoring	Continuously monitored	Plant monitored continuously via SCADA alarms
	Completed daily	Sampling of pH, DO, and flow rates are performed by Stationary Engineering Crew

Notes:
DO = dissolved oxygen
PM = preventive maintenance
SCADA = supervisory control and data acquisition

4.10.1.2 Capital Improvements

HHWP currently has one active capital project on its wastewater treatment assets, representing a total capital investment of $8.8 million. HHWP also has multiple R&R projects that are smaller in scope budget and are reported annually. Summaries for each of this active large capital projects are provided in the following sections.

Moccasin Wastewater Treatment Plant (Approved Budget: $8.8 Million; Substantial Completion: 2025)

Scope. The project will involve replacing the existing Moccasin wastewater treatment plant with a package two-train sequencing batch reactor (SBR) plant with grit removal and screening facilities, upgraded electrical and flow monitoring systems, flow equalization, SCADA instrumentation and automation features, and related site improvements.

Milestones Completed During the Reporting Cycle. The milestone achieved by the project during this reporting cycle is summarized in the Table 4-139.

Table 4-139: Moccasin Wastewater Treatment Plant Project Milestones Completed During the Current Reporting Cycle

Milestones	Completion Date
Issued Notice to Proceed under PRO-0085.C for engineering support during design and construction phases.	April 2022

Summary of Levels of Service Impacts

LOSs that are supported by the HHWP wastewater treatment capital improvements are provided in Table 4-140.

Table 4-140: HHWP Wastewater Treatment Project – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
Moccasin Wastewater Treatment Plant			✓					

Note:
HHWP = Hetch Hetchy Water and Power

4.11 Communications and Control Assets

This category includes assets related to field communications, telephone, SCADA, and facility security. WE communication infrastructure includes microwave, fiber, and cable. SCADA system platforms include Wonderware, eDNA, and OSI. Phone system platforms include Avaya. The security system platform is Lenel. Cellular phone service providers also provide valuable service beyond voice communications. 4G and LTE systems allow transmission of data such as equipment nameplates and drawings.

4.11.1 Hetch Hetchy Water Upcountry Communication Sites

Description. HHWP's communication sites interconnect water transmission assets, hydroelectric assets, electric transmission assets, and common infrastructure. There are currently 27 relevant microwave radio sites in the HHWP communication system. The communication system begins at O'Shaughnessy Dam in Yosemite National Park and extends southwest to Calaveras Substation near Sunol and the San Antonio Reservoir.

A series of Upcountry communication sites support the communication system; their sole function is to connect the assets described elsewhere in this report. They are:

Moccasin Peak Communication Site
Mt. Allison Communication Site
Burn Out Ridge Communication Site
Cherry Tower Site
Intake Radio Site
Poopenaut Pass Radio Site

Condition. These assets are in fair condition and fit for service; however, reliability can be improved by (1) replacing obsolete equipment with readily available and supported equipment; (2) constructing a backup fiberoptic path between Moccasin Control and Warnerville Switchyard; and (3) increasing spare parts inventories. Also, given the age of the microwave towers, a condition assessment of the lattice steel structures and foundations is recommended.

4.11.2 Radio

The WE current two-way radio system is made up of three separate radio systems, using different frequencies, and spans seven counties. Communication with field staff relies on three separate dispatch centers, vehicle-mounted radios, hand-held radios, and vehicle-mounted repeaters. These legacy systems have exceeded their life expectancy, have incomplete coverage, and lack

many features needed in today's utility business. This presents a challenge to maintain efficient operations and poses a safety risk when crews are working in locations where communications are unreliable. A project is underway to replace the legacy systems with a Project 25 standard, digital, modern, trunked (system selects the channel), Motorola high-band radio system. The new system will significantly improve coverage. This system will be fully integrated with, and be technically part of, the Department of Emergency Management's radio system. Once the project is complete in 2024, all SFPUC staff (along with most of CCSF staff) will be on the same radio system and technology, and operations outside of cellular coverage will be able to rely on radio as their primary means of communication.

It should be noted that cellular service reception is available in some areas. SFPUC staff continues to work with cell service providers to improve coverage by installing additional cell towers along RWS.

4.11.3Telephone

SFPUC's telephone systems primarily use Virtual Private Networks through AT&T, using the Avaya platform. These systems are used for daily business communications and are not considered reliable or available during or following a disaster. SFPUC IT Services is piloting Voice over Internet Communications for self-reliance and cost savings reasons. HHWP recently completed an upgrade, replacing old cables with networked VoIP systems running on a fiber backbone.

4.11.4 SCADA

SCADA systems continue to operate reliably and effectively, providing process automation, operational visibility, and remote control.

The Water SCADA system (which covers Regional and Local Water Operation) continued to be responsive and reliable in meeting the operational needs of RWS 24/7. Upgrades to Water SCADA system hardware and software infrastructure focused on network reliability, performance, and security. Process automation, monitoring, and control continued to be enhanced at existing facilities throughout RWS. New processes and facilities were integrated into the Water SCADA system. Examples include the Ravenswood Water Quality Monitoring Station, the HTWTP Generator Control System Upgrade, the AEP PLC Upgrade, and process refinements to the Regional Groundwater Supply Recovery well sites.

HHWP uses OSI Monarch for managing power assets and Wonderware for the water assets. Both systems require hardware and software updates. In coordination with SFPUC IT Services, HHWP plans to update both systems to the OSI platform over the next 3 years, updating both software and hardware as needed. The system will continue to be compatible with the SFPUC systems.

4.11.5On-Line Monitoring Program Review

In May 2021, SFPUC WE began a comprehensive review of its on-line water monitoring system for RWS. The project scope covered treated water remote monitoring SCADA sites from Moccasin Gate Tower down to the City's terminal reservoirs. Treatment facilities were not included in the review. The objective was to review the current monitoring sites and parameters, and identify

recommendations to encourage sustainability, reliability, accuracy, and consistency. The draft study was delivered in January 2022 and identified 594 online sensors/signals at 81 remote monitoring locations in the treated system. There are seven regulatory sites and 22 operational monitoring sites with water-quality targets. Many sites are redundant and have been installed for purposes that are no longer needed. The study will continue through 2022 and will further review maintenance records/needs, industry standards, travel time criteria, and emergency grab sampling capabilities, and make recommendations for the on-line monitoring system.

4.11.6Capital Improvements

Regional Water currently has five active capital projects on its communications and monitoring assets, representing a total capital investment of more than $20 million. Those projects are:

RWS Microwave Backbone System (10015120)
Tesla/Thomas Shaft Microwave to SVCF and Radio Replacement (10015119)
Radio Communication (10015118)

Additionally, Regional Water has multiple R&R projects that are smaller in scope and budget, and are reported annually. Summaries for each of the five active large capital projects are provided in the following sections.

RWS Microwave Backbone System (Approved Budget: $1.2 Million; Substantial Completion: 2032)

Scope. The RWS Microwave Backbone System project is a repair and replacement project. There have been no additional capital improvements identified in this cycle of the capital program for this project. The remaining $835,468 from this project were to be reallocated to the Tesla/Thomas Shaft Project. Any additional work related to this project and related facilities will be combined with and funded from the Tesla/Thomas Shaft Microwave Communications Network project.

Milestones Completed During the Reporting Cycle. There are no milestones associated with this project during this reporting cycle. This project was completed in February 2018, during the FY17/18 reporting cycle. The remaining balance was $835,468.

Tesla/Thomas Shaft Microwave to SVCF and Radio Replacement (Approved Budget: $7.6 Million; Substantial Completion: 2032)

Scope. This project (1) includes the expansion of the SFPUC microwave network to include the Thomas Shaft facility and surrounding area for security, radio communications, and SCADA;. (2) may also include the development of intermediate radio sites required to reach Thomas Shaft, or may require the installing one 160-foot communications tower; (3) requires the purchase and installing microwave backbone network equipment with a replacement cost of $1.0 million in 10 years); and (4) requires the purchase and installing a radio repeater for the Thomas Shaft Facility and surrounding area.

Milestones Completed During the Reporting Cycle. No milestones related specifically to this project were completed during this reporting cycle.

Radio Communication (Approved Budget: $11.3 Million; Substantial Completion: 2032)

Scope: The radio project replaces three WE low-frequency land mobile radio systems. The low-band radio systems are antiquated and no longer supported by the manufacturer. The goal of this project is to provide one unified interoperable land mobile radio system for business and emergency communications. CDD's, WSTD's and HHWP's low-band radio communication systems will be replaced with one public safety high-band (800 MHz, P25) radio system.

Milestones Completed During the Reporting Cycle. The project achieved multiple milestones during this reporting cycle, as summarized in Table 4-141.

Table 4-141: Radio Communication Milestones Completed During the Current Reporting Cycle

Milestone	Date Complete
Site Lease – Cedar Ridge	September 11, 2020
Microwave Design Completed	August 6, 2021
Environmental – NEPA Reviews	March 25, 2022

Note:
NEPA = National Environmental Policy Act

Summary of Levels of Service Impacts

LOSs that are supported by the communication system capital improvements are provided in Table 4-142.

Table 4-142: Communication System Projects – Levels of Service Impacts

Project	Level of Service							
	Drinking Water Quality	Regional Seismic Reliability	Regional Delivery Reliability	In-City Seismic Reliability	In-City Delivery Reliability	Water Supply	Environ. Steward.	Sustain-ability
RWS Microwave Backbone System			✓					
Tesla/Thomas Shaft Microwave to SVCF and Radio Replacement			✓					
Radio Communication			✓					
WSTD Security System R&R			✓					
Regional SCADA PLC Upgrades			✓					

Notes:
PLC = programmable logic controller
R&R = rehabilitation and replacement
RWS = Regional Water System
SCADA = supervisory control and data acquisition
SVCF = Sunol Valley Chloramination Facility
WSTD = Water Supply and Treatment Division

5. Regulatory Compliance

SFPUC is required to comply with federal and state regulations. This section will cover requirements applicable to the RWS assets. All federal and state primary drinking water standards were met within the RWS in the reporting period.

5.1 Federal and State Drinking Water Regulations

SFPUC tracks a variety of regulatory measures associated with O&M activities to ensure compliance. In addition to complying with the existing regulatory requirements, SFPUC has also been keeping track of, and actively involved in, the regulatory development of drinking water regulations at the federal and state levels. These include long-term revisions of the federal Lead and Copper Rule (the Lead and Copper Rule Revision, or LCRR); revisions of the state perchlorate maximum contaminant level (MCL) and Lead and Copper Rule; the state's revised MCL for hexavalent chromium; the state's proposed monitoring of microplastics in drinking water; and per- and polyfluoroalkyl substances (PFAS) regulations that may have impacts on RWS operations.

SFPUC maintains various emergency response plans related to drinking water regulations. Emergency response plans maintained by SFPUC are included in Appendix B, Table B-2.

5.1.1 LCRR

In January 2021, the United States Environmental Protection Agency (U.S. EPA) adopted the LCRR, which became effective starting on December 16, 2021. The LCRR includes a suite of actions requiring water systems to further reduce lead exposure to customers through drinking water. It emphasizes six key areas: identifying the most impacted area; strengthening treatment requirements; replacing lead service lines; increasing sampling reliability; improving risk communication; and protecting children in schools. A new lead "trigger level" of 10 parts per billion (ppb), in addition to the current lead Action Level of 15 ppb, will require additional actions to be taken by water systems for corrosion control treatment. However, based on U.S. EPA's mandated review of the LCRR under Executive Order 13990 in June 2021, and its subsequent conclusions in December 2021, the agency will take additional steps to strengthen the regulatory framework on lead in drinking water. U.S. EPA anticipates finalizing the Lead and Copper Rule Improvements, which are intended to improve the rules supporting the overarching goals of proactively removing lead service lines and more equitably protecting public health. Although RWS is mainly a water wholesaler operating a complicated network of transmission pipelines and treatment facilities, there are some existing retail customers who are directly connected to the transmission pipelines. An evaluation of the service lines on the customer side will have to be performed, and, if identified, any lead user service lines on the customer side will have to be replaced according to the LCRR. In the meantime, SWRCB is also working on the revision of its own version of the LCRR to align with requirements of the federal LCRR; this may possibly include additional requirements.

5.1.2 Total Coliform Rule

SFPUC conducts approximately 160 total coliform tests each month in RWS. RWS has always complied with the total coliform treatment technique (<5 percent positive tests) and E. coli MCL in accordance with the California Revised Total Coliform Rule. Total coliform positive tests are typically very low (0 to 1 percent). Over multi-year periods, there can be localized areas with increased coliform positive rates. When this occurs, an investigation is conducted, and any appropriate corrective actions are taken. If wholesale customers are impacted, they are included in the investigation. Corrective actions generally focus on the sample site or a very specific area.

5.1.3 Per- and Polyfluoroalkyl Substances

In September 2019, Governor Newsom signed Bill Assembly Bill 756 into law. This required a public water system under a SWRCB order to report monitoring results for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), two PFAS compounds, to the state and to provide public notifications, as prescribed in the bill. The previously adopted drinking water notification and response levels for PFOA and PFOS were reduced further by SWRCB in February 2020. In March 2021, SWRCB established drinking water notification and response levels for perfluorobutane sulfonic acid (PFBS). In June 2022, U.S. EPA issued interim updated drinking water health advisories for PFOA and PFOS that replace the 2016 level. At the same time, U.S. EPA issued final health advisories for two other PFAS, namely PFBS and hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (known as "GenX chemicals"). In July 2022, DDW proposed notification and response levels for perfluorohexane sulfonic acid (PFHxS), which is another member of the PFAS group.

In March 2019, SWRCB ordered select airports and landfills to investigate any impacts to nearby groundwater drinking sources and to determine whether PFAS is present. SWRCB has issued similar orders regarding PFAS monitoring at various industrial locations, urban wildfire areas, wastewater treatment facilities, and drinking water wells near these locations. SWRCB has not ordered a PFAS investigation to other community water systems, including RWS. However, to assess the presence and extent of PFAS in their sources of water supply, SFPUC proactively and voluntarily monitored for PFAS in its RWS sources at several sites—seven surface water reservoirs, AEP, TTF intake, SVWTP effluent, and HTWTP effluent—between August 2019 and February 2020. At each location, 18 different PFAS compounds were analyzed using the contemporarily available method (Method 537.1) approved by U.S. EPA and SWRCB. The monitored compounds included PFOA and PFOS. Samples were collected by SFPUC's experienced staff, following the very stringent sampling protocols established by SWRCB. These monitoring results confirmed at all RWS locations that there were no PFAS detections.

Upon completion of the first-round, voluntary PFAS monitoring indicated above—and in the absence of mandatory monitoring requirements from SWRCB—SFPUC conducted another round of voluntary PFAS monitoring for RWS using the newer analytical method (Method 533) approved by U.S. EPA. The new method mainly targets 25 short-chain PFAS contaminants. As of today, SFPUC completed two rounds of voluntary PFAS monitoring for RWS, including the eight Phase 1 RGSR wells. All results were nondetects.

In December 2021, U.S. EPA published its UCMR5. RWS has been directed to sample and analyze for the required 29 PFAS contaminants, using a combination of approved Methods 537.1 and 533. RWS is scheduled for UCMR5 monitoring in CY2023.

5.1.4 Unregulated Contaminant Monitoring Rule

Every 5 years, U.S. EPA issues a list of unregulated contaminants to be monitored by public water systems. In the Fourth Unregulated Contaminant Monitoring Rule (UCMR4) four-quarter monitoring completed in January 2019, SFPUC found quinoline, a coal-tar lining derivative, at the point of entry into the SFWS at Baden Valve Lot, at LMPS, and at the outlet at Sunset Reservoir. Although SFPUC has terminated the use of coal-tar in its repair and replacement program, there are still existing pipelines containing this type of lining. Replacing all these linings will require significant effort that can only be done over a longer period. The CSPL No. 2 Reach 5 Rehabilitation Project is currently in planning phase. Its scope includes removing 3.8 miles of coal tar enamel (CTE) lining and replacing it with CML in the existing 60-inch WSP between Millbrae Yard and Baden Valve Lot. This project is expected to be completed by 2025. The project AAR recommended using the water jetting (WJ) nonabrasive surface cleaning method to remove the existing CTE lining, with performance standard WJ-1 or WJ-2 as a minimum standard requirement before repairs and relining with CML. WJ-1 will remove existing lining to a matte finish without any visible foreign matter; WJ-2 will remove existing lining until there are stains/residues on less than 5 percent of the surface area. Given tightening regulatory requirements, and to minimize CTE leaching potential, SFPUC is planning to proceed with the WJ-1 cleaning method. Also, the CSPL No. 2 Reaches 2 and 3 Rehabilitation Project is in the planning phase; it includes replacing and relining sections of CTE-lined 60-inch WSP over approximately 2.5 miles, stretching between CSPS and the Bellevue Valve Lot. This is expected to be completed by 2026. The upcoming Fifth Unregulated Contaminant Monitoring Rule (UCMR5) will require monitoring of 30 contaminants, of which 29 are PFAS contaminants. SFPUC completed two rounds of voluntary PFAS monitoring between 2019 and 2022 and found no detections in the surface and ground water sources. However, with the advancement of analytical methods, future detection limits will be further lowered; this may present challenges to SFPUC regarding the existing nondetection status.

5.1.5 Other Revisions

In May 2021, SWRCB lowered the perchlorate detection limit for purposes of reporting (DLR) by half, and will reduce it by another 50 percent in January 2024. In the meantime, SWRCB is evaluating whether the perchlorate MCL would be revised. This may affect and incur changes to the existing RWS treatment should a much lower MCL be adopted by SWRCB in the future.

SWRCB is currently in the process of revising its MCL for hexavalent chromium, which was previous withdrawn on September 11, 2017, in response to a State Superior Court decision. A new, much lower detection limit has been proposed for chromium (VI). This, together with the new MCL, is expected to have impacts on the RGSR well operations, although new treatment facilities may not be needed.

On July 27, 2020, SWRCB adopted a definition of "microplastics in drinking water," in accordance with the requirements of Senate Bill No. 1422, which was incorporated as §116376 of California Health and Safety Code. Upon its adoption of the standard method of analysis and a policy

handbook for microplastics monitoring, SWRCB will require public water systems, probably including RWS, to monitor and report microplastics in drinking water. Although the potential impacts of the definition and monitoring results of microplastics on the treatment operations at RWS are uncertain at this time, SFPUC will closely monitor and track the regulatory development and participate in the monitoring efforts to ascertain the extent, if any, of microplastics in RWS's water sources and treated water.

U.S. EPA's microbial/disinfection byproducts (M/DBP) Stage 3 proposal is due in June 2024. All current regulations are open to review, including filtration avoidance requirements. The drinking water industry could see new regulations for NDMA, other DBPs, *Legionella*, etc. U.S. EPA is undertaking four grant projects, totaling $8.5 million, to obtain occurrence/treatment/system data. SFPUC has been asked to participate in at least two proposals. SFPUC is also part of the Water Research Foundation (WRF) 5156 *Legionella* occurrence data collection project (meant to inform the M/DBP Stage 3 proposal), with monitoring starting in August 2022. SFPUC's Millbrae Lab has developed internal *Legionella* testing capability for this project.

5.1.6 Drinking Water Permit Compliance

SWRCB DDW is responsible for implementing and enforcing drinking water regulations in California. SFPUC tracks a variety of regulatory measures associated with O&M activities to ensure compliance, including the drinking water system permit administered by the SWRCB DDW. All federal and state primary drinking water standards were met within the RWS in the reporting period (FY21 and FY22).

5.2 Environmental Compliance

The WE Environmental Stewardship Policy provides direction for the management of the lands and natural resources that affect or are affected by operations of SFPUC, and this policy includes complying with federal and state environmental regulations. Environmental compliance is also an objective of the Environmental Stewardship Policy goal under the Water System LOS, and reduces risk associated with uncertainty related to water supply reliability. The Environmental Stewardship Policy is the responsibility of all WE employees, and training is a critical aspect of providing staff with the information necessary to meet this goal. The specific Environmental Stewardship Policy strategies are incorporated into the regular tailgate trainings performed for WE staff, based on their work assignments and locations, to ensure that staff receive this information as part of their regular responsibilities. WE also submits a report to SFPUC every 2 years, summarizing the implementation of the Environmental Stewardship Policy. The most recent report was submitted at the June 23, 2020, meeting.

The SFPUC's environmental compliance starts with impact avoidance. SFPUC activities are reviewed and modified as needed to incorporate BMPs and environmental impact avoidance measures whenever feasible. When impacts cannot be avoided, permits are obtained to comply with environmental laws and regulations, such as the California Fish and Game Code, the Clean Water Act, and the California and federal Endangered Species Acts. San Francisco's Planning Department prepares any necessary California Environmental Quality Act documentation, and SFPUC oversees the compliance with the requirements of these documents. If a project triggers compliance with federal regulations, NRLMD works with the federal lead agency to prepare any required National

Environmental Policy Act documents. Applications for third-party use of SFPUC-owned watershed and ROW lands are also evaluated for environmental compliance and consistency with SFPUC plans and policies through the Project Review process. SFPUC regularly evaluates environmental compliance procedures and protocols to streamline the processes and ensure that they are consistent across the system. Environmental compliance for O&M activities is documented through Maximo, in coordination with HHWP and WSTD maintenance planning teams, and the Project Review process; larger projects maintain separate project-specific records of environmental compliance.

The SFPUC's environmental regulatory compliance includes the fulfillment of the mitigation commitments from WSIP. These WSIP commitments include monitoring and maintenance of the Bioregional Habitat Restoration (BHR) projects; permit-required releases and bypass flows to benefit aquatic species below SFPUC dams and diversion structures; and amphibian and fish monitoring in Alameda and San Mateo creeks. The BHR includes approximately 2,000 acres of lands set aside in perpetuity on the Alameda and Peninsula watersheds that must be maintained and monitored to meet specific environmental performance measures, as well as conservation bank credit purchases in the San Joaquin Valley. Support for the BHR effort was initially funded by WSIP bond funds; in recent years, this has been increasingly supplemented by CIP bond and programmatic funds. This will continue, and CIP funds will be used to cover costs until an endowment can be established and the BHR effort can become self-sustaining.

SFPUC environmental permitting and compliance efforts include routine maintenance agreements and lake and streambed alteration agreements with the California Department of Fish and Wildlife; permits for compliance with Sections 401, 402, and 404 of the Clean Water Act; California Air Resources Board permits; compliance with hazardous materials regulations; and federal special use permits with the NPS, USFS, and the Bureau of Land Management.

5.2.1 National Pollutant Discharge Elimination System Permit Compliance

In 2016, the NPDES statewide drinking water discharges permit (NPDES permit number CAG140001) went into effect, and SFPUC received coverage on January 20, 2016. This permit replaced the individual permit for the Pulgas Dechloramination Facility, and the General NPDES permit for surface water treatment facilities. Coverage under this statewide permit is comprehensive, because it includes chlorinated drinking water as well as groundwater, and spans the entire RWS from Hetch Hetchy to CCSF's county line. Also in 2016, filter backwash discharges at HTWTP were covered under a new NPDES permit (NPDES permit number CAG382001). In 2021, this NPDES permit was reissued, and it continues to provide coverage for filter backwash discharges at HTWTP. SFPUC continues to receive coverage for discharges of aquatic pesticides (i.e., algaecides) into drinking water reservoirs under the general aquatic pesticide application permit (NPDES permit CA990005). The SFPUC NPDES permit coverage is provided by these three NPDES permits, and SFPUC continues to work with the state and regional boards to meet permit requirements and minimize impacts to receiving waters.

5.2.2 California Unified Program Compliance (Hazardous Waste and Materials)

The Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program) was established in 1993 to protect public health and safety, and to restore and

enhance environmental quality. The Unified Program is overseen by the California Environmental Protection Agency (CalEPA), coordinating with partner state agencies to ensure consistency and to set program standards established by Cal OES, the Department of Toxic Substances Control, the Office of the State Fire Marshal, SWRCB, and CalEPA. The Unified Program organizes the administration and activities of six programs:

1. Aboveground Petroleum Storage Act Program
2. California Accidental Release Prevention Program
3. Hazardous Materials Business Plan Program
4. Hazardous Materials Management and Inventory Program (Generator Program)
5. Hazardous Waste and Hazardous Waste Treatment Program (Tiered Permitting)
6. Underground Storage Tank Program

Water treatment plants are overseen by the following programs: Aboveground Petroleum Storage Act (Table 5-1), California Accidental Release Prevention Program (Table 5-2), and Hazardous Generator or Hazardous Material Business Plan Program (Table 5-3). The majority of the pump stations, valve lots, and smaller facilities are overseen by the Hazardous Materials Business Plan Program, Hazardous Waste Generator Program, and Underground Storage Tank Program. Table 5-4 shows the various facilities and the different programs responsible for oversight of the facilities.

Table 5-1: Facilities in the Aboveground Storage Tank Program

Facility Name	Last Revised
Early Intake	2021
Moccasin	2021
Warnerville	2022
Baden Pump Station	2021
Harry Tracy Water Treatment Plant	2021
San Antonio Pump Station/Sunol Valley Chloramination Facility	2021
Santa Clara Valley Intertie Pump Station	2021
Sunol Valley Water Treatment Plant	2021
Tesla Treatment Facility	2022
Millbrae Yard	2022
Sunol Corporation Yard	2020

Table 5-2: Facilities in the California Accidental Release Prevention Program

Facility Name	Last Revised
Harry Tracy Water Treatment Plant	2020
San Antonio Pump Station/Sunol Valley Chloramination Facility	2021
Sunol Valley Water Treatment Plant	2021

Table 5-3: Facilities in the Hazardous Generator and Hazardous Material Business Plan Program

Facility Name	Last Revised
O'Shaughnessy	2021
Cherry Valley Compound	2021
Early Intake	2021
South Fork Maintenance Yard	2022
Moccasin	2021
Rock River Lime Plant	2022
Warnerville	2022
Harry Tracy Water Treatment Plant	2022
Millbrae Maintenance Yard	2022
Baden Pump Station	2022
Crystal Springs Pump Station	2022
Pulgas Dechloramination Facility and Pump Station	2022
Polhemus Fluoride Station	2022
Tesla Treatment Facility	2022
San Antonio Oxygenation Facility	2022
Sunol Valley Chloramination Facility/San Antonio Pump Station	2022
Sunol Valley Water Treatment Plant	2022
Casey Quarry	2022
Crystal Springs Bypass Tunnel and Shaft	2022
SFPUC-Valley Water Intertie Pump Station	2022
Thomas Shaft Facility	2022
Sunol Corporation Yard	2022
Calaveras Oxygenation Facility	2022
Bear Gulch Crossover Facility	2022
Mt. Alviso Valve Lot	2022
Calaveras Valve Lot	2022
Guadalupe Crossover	2022
Palo Alto (Barron) Valve Lot	2022
Newark Control Building	2022
Irvington Portal	2022
San Pedro Valve Lot	2022
Ravenswood Control Building	2022
Alameda East Portal	2022
Alameda West Portal	2022
F Street Well and Treatment Facility	2022
Drive Well and Treatment Facility	2022
Serramonte Boulevard Groundwater Treatment Facility	2022
Hickey Boulevard Well and Treatment Facility	2022
Mission Well and Treatment Facility	2022
Southwood Drive Well and Treatment Facility	2022
Millbrae Yard Well and Treatment Facility	2022
Sunol Fire Pump Station	2022
Alameda Creek Diversion Dam Fish Passage Facility	2022
Pulgas Valve Lot	2022

Note:
SFPUC = San Francisco Public Utilities Commission

Table 5-4: Number of SFPUC Division Facilities Enrolled in the Unified Program

Type of Program in the Unified Program	Number of Facilities in the Program
Aboveground Petroleum Storage Act Program	11
California Accidental Release Prevention Program	3
Hazardous Materials Business Plan Program	44
Hazardous Materials Management and Inventory Program (Generator Program)	39
Hazardous Waste and Hazardous Waste Treatment Program (Tiered Permitting)	2
Underground Storage Tank Program	1

Note:
SFPUC = San Francisco Public Utilities Commission

Certified Unified Program Agencies implement the Unified program at the local level by consolidating and coordinating administrative requirements, permits, inspections, and enforcement activities for the six programs. Depending on the location of the facility, the Certified Unified Program Agencies for WSTD include San Joaquin County Department of Environmental Health, Alameda Department of Environmental Health, Santa Clara Department of Environmental Health, City of Sunnyvale, and San Mateo Environmental Health Services.

WSTD facilities either carry hazardous materials over a certain threshold or generate hazardous waste, which puts these facilities under the Unified Program. For example, hazardous materials at some of the WSTD facilities include aqua ammonia, ammonium sulfate, fluoride, sodium bisulfite, sodium hydroxide, petroleum products, and cylinders of gases (i.e., oxygen, argon, carbon dioxide, and nitrogen). Hazardous materials at pump stations and valve lots may include propane or diesel generators. Hazardous waste generated at the pump stations and valve lots include the used oil from the generators. The goal of the Unified Program is to protect lives, property, and the environment by reducing the factors that contribute to emergencies associated with hazardous materials.

WSTD complies with the Unified Program to protect the staff, customers, community, and environment from adverse effects as a result of the storage or possible release of hazardous materials and waste. This is done primarily by documenting significant amounts of hazardous materials so that emergency responders can effectively protect the public. WSTD continuously updates their plans to ensure regulatory compliance with the Unified Program by working with the local Certified Unified Program Agencies.

Similarly, HHWP continuously updates their plans to ensure regulatory compliance with the Unified Program. HHWP must maintain various permits/plans/procedures for their operations, including wastewater permits, discharge permits, Stormwater Pollution Prevention Plans, and Hazardous Materials Business Plans. Permitting is current and up to date. All hazardous material/waste permits are captured in California's Environmental Reporting System. CalEPA oversees California's Unified Program. The Unified Program is a consolidation of multiple environmental and emergency management programs. Under the Clean Water Act, U.S. EPA

authorizes the NPDES permit program to state, tribal, and territorial governments, enabling them to perform many of the permitting, administrative, and enforcement aspects of the NPDES program. California is authorized to implement Clean Water Act programs through SWRCB; CalEPA retains oversight responsibilities over SWRCB, which administers wastewater and stormwater discharge permits. HHWP also maintains small water systems permits and operations plans for facilities at Moccasin, Early Intake, O'Shaughnessy, and Cherry Valley.

A comprehensive list SFPUC program plans for can be found in Appendix B, Table B-2. Emergency response plans maintained by SFPUC can be found in Appendix B, Table B-1.

5.3 State of California Division of Safety on Dams

DSOD has jurisdiction over 12 dams that are operated and maintained by HHWP and WSTD within the SFPUC's WE. The dams that are regulated by DSOD include:

O'Shaughnessy Dam
Lake Eleanor Dam
Cherry Valley Dam
Early Intake Dam
Priest Dam
Moccasin Dam
Calaveras Dam
Turner Dam
Pilarcitos Dam
Upper and Lower Crystal Springs Dams
San Andreas Dam

DSOD categorizes the condition of each of these dams within its jurisdiction as either Satisfactory, Fair, Poor, Unsatisfactory, or Not Rated.

- **Satisfactory:** No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, and seismic), in accordance with the applicable regulatory criteria or tolerable risk guidelines.

- **Fair:** No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Additional DSOD criteria may include:

  - The dam has a long-standing deficiency that is not being addressed in a timely manner.
  - The dam is not certified and its safety is under evaluation.
  - The dam is restricted and operation of the reservoir at the lower level does not mitigate.

- **Poor.** A dam safety deficiency is recognized for loading conditions that may realistically occur. Remedial action is necessary. A poor rating may also be used when uncertainties exist regarding critical analysis parameters that identify a potential dam safety deficiency. Further investigations and studies are necessary. Additional DSOD criteria can include the following:

  - The dam has multiple deficiencies or a significant deficiency that requires extensive remedial work.

- **Unsatisfactory.** A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

- **Not Rated.** The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

WE has identified the need for capital improvements on its dams and continues to work closely with DSOD on the scope and schedule for these investments. As reported in the previous SRWS Report, SFPUC delivered to DSOD a conceptual plan for implementing known dam safety projects over the next 15 years, the 15-Year Dam Safety Plan. DSOD has reviewed and responded favorably to the conceptual plan. SFPUC continues to make progress on the dam safety projects that are currently authorized under the existing 10-Year CIP.

In addition to the large capital projects that were identified in the 15-year Dam Safety Plan, WE manages a thorough dam safety program that includes inspection, surveillance, and monitoring tasks for each of its facilities. This program is executed by a diverse set of dam safety professionals, including engineers, watershed keepers, hydrologists, and other technical staff.

5.3.1 Dam Safety Program

The Dam Safety Program includes (1) field inspection and monitoring activities, (2) valve exercising, and (3) vegetation management.

5.3.1.1 Field Inspections and Monitoring

Field inspections consist of routine inspections, formal annual inspections, and episodic inspections, accompanied by engineering surveys following seismic events of specified magnitude.

Routine inspections are conducted by SFPUC staff, including engineering survey crews and watershed keepers. Staff record readings on piezometers and seepage drains, and also perform routine visual inspection of spillways and appurtenances. The survey crew conducts a routine dam displacement survey on monuments for vertical and horizontal movements.

Annual inspections are conducted by the DSOD inspector, together with the SFPUC inspection team. DSOD inspects the upstream and downstream face of the dam, the crest and toe areas of the dam, groins, seepage points, spillways, spillway basins, outlet structures, tunnels, valves, piping, and metalwork. The DSOD inspector typically observes the exercising of outlet valves once every 3 to 5 years. DSOD issues a written report to SFPUC after each annual inspection to summarize their findings and recommendations. As part of their annual report, DSOD reviews monitoring data, such as piezometers, deflection and settlement surveys, and seepage monitoring. Annual inspections were performed by DSOD in FY21 and FY22.

At HHWP, monitoring data are collected manually during the routine monthly inspection and the bi-annual engineering survey. At WSTD, monitoring data are collected through both manual reading on site and through dataloggers with data transmitted to the office. The monitoring data include piezometer readings, seepage flows, survey readings, reservoir levels, and rainfall information. Piezometer readings, reservoir levels, and rainfall data are plotted over a 10-year period to identify trends. Piezometer readings, which represent water pressure, are labeled on each dam cross-section to illustrate the internal phreatic surface. Survey readings that show horizontal and vertical movement are summarized in a tabular format with a 10-year history. Monitoring data are a central element in the reports submitted to DSOD each year. Maintenance

and repair consist of annual flushing of piezometer piping and DSOD annual inspection recommendation follow-ups. Flushing of hydraulic piezometer piping is required to maintain proper operation. DSOD annual inspection recommendation follow-ups generally consist of vegetation clearing, rodent control, minor spillway repair, and repair of seepage measuring devices. These activities are included in the operating budget. Inspections and engineering surveys are required following an earthquake, depending on the magnitude of the earthquake and its proximity to the dam. For WSTD, the inspection and survey criteria are specified in the EAPs for each dam. These surveys are conducted immediately or during the next available daylight period. The EAPs are required by law to be updated annually or whenever changes are made. For HHWP, criteria are specified in HHWP's Earthquake Notification Procedure. No earthquakes triggering surveying have been experienced on the HHWP project recently.

5.3.1.2 Maintenance – Valve Exercising

WSTD's valve exercising program requires exercising adit and emergency release valves for each dam once per year. Every 3 to 5 years, DSOD inspectors, along with a WSTD engineer and inspector, will need to witness the valve exercising for each dam. A wet test with all the valves fully opened and closed is preferred. When environmental restrictions prevent the full release of water downstream (as was the case for Turner Dam and LCSD), a dry test will be done by opening and closing the emergency release valves with the adit valves and line-valves closed (thus not allowing any water to go downstream). After testing, the emergency release valve is then closed, and the adit valves and line valves are opened and closed.

HHWP's program requires exercising the release valves for each dam once per year. This activity is scheduled in Maximo and performed by the watershed keepers. At least once every 3 years, DSOD inspectors, along with a HHWP engineer and inspector, witness the valve exercising for each dam. Though a wet test with all the valves opened is preferred, a dry test will be done (not allowing any water to go downstream) during dry hydrologic conditions. Valve exercising tasks for each dam are summarized in Section 4.

5.3.1.3 Maintenance – Vegetation Management

SFPUC and DSOD inspections regularly trigger vegetation and rodent clearance work along dams and spillways. Work is transmitted to the maintenance crews for completion either by memorandum from the engineering section (WSTD) or by Maximo work order (HHWP). Vegetation work completed is summarized for each dam in Section 4.

5.3.2 DSOD Inspections

During this reporting cycle, DSOD performed joint inspections with WE staff at multiple dams. This section summarizes the dates of the inspections, the current DSOD condition category, and a brief description of the findings of the inspection for each of the dams.

5.3.2.1 O'Shaughnessy Dam

DSOD categorizes the condition of O'Shaughnessy Dam as "Satisfactory." HHWP personnel performed joint inspections with DSOD at O'Shaughnessy Dam on November 16, 2020; April 20, 2021; April 19, 2022; and May 12, 2022. This included exercising valves, exercising drum gates, and performing visual inspections of the dam. Inspections went well, confirming the satisfactory

condition of the dam; however, some minor maintenance items were identified and are being addressed.

5.3.2.2 Cherry Valley Dam

DSOD categorizes the condition of Cherry Valley Dam as "Satisfactory." HHWP personnel performed joint inspections with DSOD at Cherry Valley Dam on April 21, 2021; and May 13, 2022. This included exercising valves and performing visual inspections of the dam. Inspections went well, confirming the satisfactory condition of the dam. However, the weirs are nonstandard and the readings are somewhat suspect and in need of replacement, which is currently being planned. Earlier, in 2020, the DSOD inspector recommended vegetation removal at the groins. In the 2021 and 2022 inspections, the DSOD inspector noted that this issue continues to be successfully addressed.

5.3.2.3 Eleanor Dam

DSOD categorizes the condition of Eleanor Dam as "Satisfactory." HHWP personnel performed joint inspections with DSOD at Eleanor Dam on November 17, 2020; April 21, 2021; and May 13, 2022. This included exercising valves and performing visual inspections of the dam. Inspections went well, confirming the satisfactory condition of the dam; however, some maintenance items were identified. DSOD has been requesting the repair of the spillway bays, diversion wall, and some minor repairs to the upstream right abutment contact for years now. This is being addressed by HHWP's O&M staff but has not been completed due to staffing shortages. This work is also experiencing ongoing delay due to the current condition of the access bridge across the dam, which is limiting access for the concrete needed to make the repairs or contract this work out. Progress continues to be made, although not as quickly as DSOD would prefer.

5.3.2.4 Priest Dam

DSOD categorizes the condition of Priest Dam as "Satisfactory." HHWP personnel performed joint inspections with DSOD at Priest Dam on March 16, 2021; and February 17, 2022. This included exercising valves, performing visual inspections of the dam, and reviewing the blasting monitoring measures associated with the new Mountain Tunnel Adit and Access Shaft. Inspections went well, confirming the satisfactory condition of the dam. DSOD provided positive comments regarding the new standardized weirs and cutoff wall installed by HHWP, which improves SFPUC's ability to monitor the leakage from the dam and low level outlet tunnel. During the inspection, DSOD requested additional monitoring stations by and on the dam, for more accurate effects of construction and blasting work. The contractor for Mountain Tunnel installed the additional monitoring under the direction of DSOD.

5.3.2.5 Moccasin Dam

DSOD categorizes condition rating as "Fair," and the rating will not be increased until the pending capital work on its spillway is complete. HHWP personnel performed joint inspections with DSOD at Moccasin Dam on March 16, 2021; February 17, 2022; and May 17, 2022. This included exercising valves and perfuming visual inspections of the dam. Inspections went well, confirming the satisfactory condition of the dam. However, DSOD is still awaiting a proposal for improvements to the spillways of Moccasin Lower Dams; this is needed to address the revised Probable Maximum Flood (PMF) event, following the 2018 flood event that occurred in Moccasin.

5.3.2.6 Early Intake Dam

DSOD categorizes the condition of Early Intake Dam as "Fair" due to the condition of the dam's concrete. HHWP personnel performed joint inspections with DSOD at Early Intake Dam on March 16, 2021; February 17, 2022; and April 19, 2022. This included exercising valves and performing visual inspections of the dam. Inspections went well, confirming the satisfactory condition of the dam; however, DSOD is still awaiting the proposal for a long-term solution for Early Intake Dam.

5.3.2.7 Calaveras

DSOD categorizes the condition of Calaveras Dam as "Satisfactory." WSTD personnel performed joint inspections with DSOD at Calaveras Dam on October 30, 2020; November 13, 2020; December 16, 2021; and April 22, 2022. This included exercising valves and performing visual inspections of the dam, spillway, and outlet structure. Inspections went well, confirming the satisfactory condition of the dam; however, some maintenance items, such as vegetation removal and minor crack repairs, were identified and will be addressed.

5.3.2.8 Alameda Creek Diversion Dam

The Upper Alameda Creek Diversion Dam is not a DSOD jurisdictional dam. The dam is structurally sound. The recent WSIP project (2019) modified the dam under CDRP, adding a new fish passage ladder and screened intake into the diversion tunnel that leads to Calaveras Reservoir. Diversions through the Alameda Creek Diversion Tunnel (ACDT) to Calaveras Reservoir occurred in spring 2020. Downstream bypass flows have been provided, consistent with the permitting requirements.

5.3.2.9 Turner Dam

DSOD categorizes the condition of Turner Dam as "Satisfactory." WSTD personnel performed joint inspections with DSOD at Turner Dam on June 12, 2020; October 30, 2020; December 16, 2021; and March 14, 2022. This included exercising valves and performing visual inspections of the dam, spillway, and outlet structure. Inspections went well, confirming the satisfactory condition of the dam. Maintenance items identified in the inspections include removal of woody vegetation in the stilling basin, repair of hillside erosion adjacent to the outlet structure access road, and collapsing of rodent holes. With the exception of repairing some hillside erosion, the rest of the maintenance items have been addressed.

5.3.2.10 Lower Crystal Springs Dam

DSOD categorizes the condition of Lower Crystal Springs Dam as "Satisfactory." WSTD personnel performed joint inspections with DSOD at Lower Crystal Springs Dam on December 9, 2020; and December 14, 2021. This included exercising valves and performing visual inspections of the dam, spillway, and outlet structure. Inspections went well, confirming the satisfactory condition of the dam; however, maintenance issues such as vegetation removal and maintaining access to monitoring points were identified and are being addressed.

5.3.2.11 Upper Crystal Springs Dam

Although it crosses the San Andreas fault, no improvements to the dam are planned. The culverts conveying water into LCSR were repaired and strengthened under WSIP.

5.3.2.12 San Andreas

DSOD categorizes the condition of San Andreas Dam as "Fair," due to major deficiencies in the spillway. WSTD personnel performed joint inspections with DSOD at San Andreas Dam on December 9, 2020; December 14, 2021; and December 15, 2021. This included exercising valves and performing visual inspections of the dam, spillway, and outlet towers. The spillway requires major upgrade, which is included in the CIP program. During inspection, an electrical issue was discovered in one valve, and rodent holes were observed. These issues are being addressed.

5.3.2.13 Pilarcitos

DSOD categorizes the condition of Pilarcitos Dam as "Satisfactory." WSTD personnel performed joint inspections with DSOD at Pilarcitos Dam on December 9, 2020; December 15, 2021; and January 25, 2022. This included exercising valves and performing visual inspections of the dam, spillway, and outlet towers. Inspections went well, confirming the satisfactory condition of the dam; however, some maintenance items such as rodent holes and minor concrete cracks were identified and will be addressed.

5.3.2.14 Stone Dam

Stone Dam, downstream of Pilarcitos Reservoir, is in satisfactory structural condition. However, structural deterioration of the spillway access structure prevents operational use of its stop logs, and the reservoir storage capacity is severely limited due to sediment deposition and a lack of regular dredging.

5.4 America's Water Infrastructure Act

SFPUC has conducted a risk and resilience assessment (RRA), as required by the America's Water Infrastructure Act of 2018 (AWIA). In October 2018, the AWIA was signed into law, requiring water utilities serving more than 3,300 persons to conduct an RRA and update their ERP, based on specific criteria outlined in the Act. The compliance deadline for SFPUC to complete their RRA was March 31, 2020; the ERP was due September 30, 2020. Both were completed, and certifications sent to U.S. EPA.

Pursuant to the AWIA requirements, SFPUC conducted an RRA to evaluate:

- risks to the system from malevolent acts and natural hazards; and
- resilience of system components, in consideration of monitoring practices, financial infrastructure, chemical storage and handling, and O&M.

The RRA was completed using a methodical process based on the AWWA J-100 methodology:

- **Asset Characterization.** A list was established of SFPUC's critical assets that, if compromised, could result in service interruption. Assets included the various source water, treatment, distribution, storage, and cyber assets associated with the drinking water system. AWIA applies only to drinking water systems; therefore, the wastewater and stormwater assets were not included in this effort.

- **Threat Characterization.** A set of hazard scenarios was identified, taking an all-hazards approach as required by AWIA, to evaluate credible threats to SFPUC. The threats included major earthquake, flood, wildfire, power outage, physical assault, water quality contamination, cyber-attack, and resource interruption.
- **Consequence Analysis.** AWIA consequence of failure was identified for identified assets.
- **Vulnerability and Threat Analysis.** The probability of failure was estimated for threat-asset pairs developed from the asset and threat characterizations.
- **Risk and Resilience Analysis.** The results were combined into an estimated risk analysis for identified and evaluated threat-asset pairs.

RRA Summary

- **Seismic:** As part of the Facilities Reliability Program and WSIP, SFPUC performed an extensive multi-year evaluation of seismic risks to its water system; this resulted in major capital improvements to increase seismic reliability. 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, and magnitude 6.9 event on the Calaveras Fault. For the seismic risk and resilience of AWIA compliance, SFPUC defers to the body of analysis performed to support WSIP. The risks associated with the seismic scenarios considered are reflected in the delivery objectives established in the LOS. Notwithstanding the numerous seismic improvements to the water system, delivery will be contingent upon resources and infrastructure available for restoration.
- **Flood:** The flood hazard evaluation is based on the 100-year flood scenario. The broadly accepted 100-year flood maps developed by the Federal Emergency Management Agency are used for this analysis, and the associated likelihood of occurrence is 1 percent annually. For the purposes of this assessment, the conservative assumption is that the operation of facilities in areas within the delineation of the 100-year flood will be impacted.
- **Wildfire:** The wildfire hazard evaluation uses California Department of Forestry and Fire Protection Fire Hazard Severity Zone (FHSZ) Map data to evaluate fire hazard at facility locations. The hazard mapping considers factors such as fuel, terrain, weather, fire history, expected fire behavior, and expected burn probabilities. The state's FHSZ data do not reflect a probability of occurrence for wildfires; however, over the last 30 years, California has experienced an average of more than 8,700 wildfires per, year burning an average of more than 570,000 acres (California State Hazard Mitigation Plan, September 2018).
- **Power Outage:** The assessment of power outage risk evaluates the direct impact to operation of facilities in the event of a primary power outage due to public safety power shutoffs (PSPSs) and other causes. Given the California Public Utilities Commission's approval of PSPS guidelines as a preventative measure against imminent and significant fire risk, and the implementation of these procedures in 2019, it is reasonable to expect power outages to occur on a nearly annual basis.

- **Physical Assault:** The physical assault threat addresses scenarios of terrorist threat, sabotage, and/or vandalism on utility infrastructure or staff, as well as malicious physical acts with the intention of impacting facility operations. Depending on location and desirability, assets may be considered rare to unlikely targets.

- **Source Water Contamination:** The water quality contamination hazard/threat considers unintentional (e.g., accidental, natural hazards, and other causes outside the control of SFPUC) and intentional (e.g., malevolent acts) contamination of raw and treated water. Water quality events, such as high turbidity events, may occur due to severe weather, fire, earthquake, etc. Events may affect Hetch Hetchy supply and source waters for SFPUC water treatment plants. Water treatment plant failure may occur due to process failure, such as filtration problems; or contamination may occur at treated water storage facilities. The likelihood of occurrence is based on U.S. EPA's Baseline Information on Malevolent Acts for Community Water Systems (July 2019).

- **Cyber-Attack:** This threat scenario addresses the potential for cyber-attack of business enterprise (e.g., financial or data management) and process control (e.g., SCADA) systems. Depending on asset dependencies such as telecommunications, the likelihood of occurrence range from possible to unlikely.

- **Resource Interruption:** Resource interruptions, such as major staff shortfalls and supply interruptions for critical consumables such as treatment chemicals, can potentially impact the operation of the water system. These interruptions may result from events such as natural disasters, transportation incidents, civil disruption, or pandemic outbreaks. Due to the broad range of potential causes and impacts, the hazard will be addressed in a holistic manner. A range of probabilities of occurrence is assigned depending on asset dependencies, and to reflect a conservative approach given the level of uncertainty.

Pursuant to AWIA requirements, SFPUC prepared an ERP that incorporates the findings of the RRA and describes SFPUC's strategies, resources, plans, and procedures to prepare for and respond to an incident, natural or man-made, that threatens life, property, or the environment. The SFPUC ERP acts as a unifying document and integrates and references common components of SFPUC plans and programs that have been developed to date, including but not limited to the SFPUC EOP and various division, bureau, and enterprise EOPs. Plans and procedures outlined and/or referenced in this document will be implemented to the extent required, depending on the type and severity of the major emergency or disaster. Types of events affecting SFPUC that may require the immediate, accurate, and coordinated use of 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, and man-made or intentional acts of terrorism resulting in damage to system or interruption of service.

SFPUC is required to review, revise, and submit a recertification of the RRA every 5 years. SFPUC will host AWIA discussion sessions with customers as needed (up to annually) to promote collaboration, and provide an opportunity to share compliance strategies, actions, and outcomes. Sessions to date were hosted in October of 2020 and August of 2022.

5.5 Federal and State Power Regulations

5.5.1 North American Electric Reliability Corporation/Western Electricity Coordinating Council

North American Electric Reliability Commission (NERC) is the Federal Energy Regulatory Commission-approved authority that develops and enforces reliability standards for the bulk electric system in Northern America. SFPUC owns power generation and transmission assets that fall under the jurisdiction of NERC's Reliability Compliance Program. NERC oversees the Western Electricity Coordinating Council (WECC), which is SFPUC's regional entity for the western interconnection. WECC is responsible for compliance monitoring and enforcement, and oversees reliability planning and assessments. HHWP is the responsible entity for these regulatory activities.

Enforcement Actions: SFPUC self-reported three violations during the reporting cycle. Mitigation activities are complete, and SFPUC is awaiting final disposition of violations from WECC.

WECC Compliance Audit: In August 2020, WECC performed its Operation and Planning and Critical Infrastructure Protection Compliance Audit of the SFPUC program. The audit's scope covered 11 reliability requirements from nine NERC reliability standards, including three open enforcement actions. The next audit will occur in June 2023. The 2020 audit results are summarized in the following paragraphs.

- Eight of the 11 reliability requirements were audited with "No Findings."
- One self-reported violation was confirmed without expanding scope. After the audit, SFPUC received a Notice of Compliance Exception, closing this violation with no penalties or further actions required.
- One self-reported violation was confirmed with additional instances of noncompliance. SFPUC is awaiting additional information from WECC regarding any additional mitigation actions required.
- One self-reported violation is being recommended for dismissal. This self-report currently remains open, but no further action is required by SFPUC at this time.

Self-Certification: In February 2021, SFPUC completed the annual WECC self-certification process for calendar year 2020. SFPUC was required to self-certify to two operation and planning and five critical infrastructure protection reliability requirements. SFPUC did not identify any violations during the self-certification process. SFPUC was not required to self-certify in 2022 for calendar year 2021.

5.5.2 Federal Energy Regulatory Commission (FERC)

5.5.2.1 Scope and Jurisdiction

FERC has regulatory jurisdiction over the operation of HHWP's Moccasin Lowhead Powerhouse. HHWP is required to provide documentation and facilitate inspections to maintain compliance.

5.5.2.2 Status and Updates

During this reporting cycle (July 1, 2020, through June 30, 2022), Moccasin Lowhead Powerhouse has been out of service. A flood on Moccasin Creek damaged the powerhouse, resulting in ongoing remediation since 2018. The powerhouse is expected to return to service in March 2023.

5.5.3 Wildfire Mitigation Plan

California Senate Bill (SB) 901 (2018), amended Public Utilities Code (PUC) § 8387, Chapter 6, Wildfire Mitigation. PUC section 8387 (b)(1) requires that "the local publicly owned electric utility or electrical cooperative shall, before January 1, 2020, prepare a wildfire mitigation plan. After January 1, 2020, a local publicly owned electric utility or electrical cooperative shall annually prepare a wildfire mitigation plan. It shall submit the plan to the California Wildfire Safety Advisory Board (WSAB) on or before July 1 of that calendar year. Each local publicly owned electric utility and electrical cooperative shall update its plan annually and submit the update to the WSAB by July 1 of each year. At least once every 3 years, the submission shall be a comprehensive revision of the plan." In June 2022, the most recent annual report was submitted to the commission and the state, as required.

SFPUC maintains a Wildfire Mitigation Plan (WMP). The WMP is built on the following primary objectives:

1. Minimizing Sources of Ignition. SFPUC continues to evaluate prudent and cost-effective improvements to its physical assets, operations, and training to minimize the risk of its facilities being the origin or contributing source of a catastrophic wildfire. These programs include, but are not limited to, implementation of fire risk analysis tools to assess the risk and consequence of a potential ignition; strategic grid hardening, such as replacing high-risk equipment on distribution poles; an increase in situational awareness capabilities, achieved by adding more strategically placed weather stations; and proactive de-energization of lines during critical fire weather conditions. SFPUC will continue to implement additional recommendations over time through WMP evaluation and continuous improvement.

2. Grid Reliability and Resiliency. The second objective is to improve the reliability and resiliency of SFPUC-owned and operated electric grid. In addition to reducing wildfire ignition risks, programs such as grid hardening and enhanced vegetation management provide additional benefits such as improved reliability and resiliency. SFPUC will continue to assess industry best practices and new technologies that could help reduce the likelihood of a disruption in service due to planned or unplanned events; and expedite grid recovery efforts following a significant event, such as a fire.

3. Measurement of Effectiveness and Performance. The third objective of this WMP is to measure the effectiveness and performance of SFPUC's specific wildfire mitigation strategies. SFPUC will monitor the performance—e.g., the increased rate of equipment failures or vegetation contacts. Based on performance, SFPUC will modify their program in an effort to continuously improve the safety, reliability, and resiliency of their equipment.

5.5.4 Physical Security Mitigation Plan

On January 10, 2019, the California Public Utilities Commission issued Decision 19-01-018 (Decision), requiring electrical utilities—including publicly owned utilities such as SFPUC—to identify electric distribution infrastructure subject to the Decision (Covered Distribution Facilities or CDFs), assess the potential risks associated with a physical attack on CDFs, and prepare a risk mitigation plan.

The Decision requires evaluation of the following elements of the existing design and operations of a CDF, and identification of the potential risks associated with a physical attack:

- existing power system resiliency and/or redundancy solutions (e.g., identifying other facilities capable of serving the load, temporary circuit ties, mobile generation, and/or storage solutions);
- availability of spare assets to restore a particular load;
- existing physical security protections to reasonably address the risk;
- potential for emergency responders to identify and respond to an attack in a timely manner;
- location and physical surroundings, including proximity to gas pipelines and geographical challenges and impacts of weather;
- history of criminal activity at the facilities in the area;
- availability of other sources of energy to serve the load (e.g., customer-owned backup generation or storage solutions); and
- availability of alternative ways to meet health, safety, or security needs.

SFPUC prepared a Physical Security Mitigation Plan (PSMP) for applicable CDFs. In accordance with the Decision, SFPUC appointed the Executive Director of the San Francisco Department of Emergency Management to act as the *qualified authority* to review the PSMP. The final PSMP incorporates recommendations from the qualified authority. SFPUC will review and update the PSMP every 5 years.

6. Emerging Issues

There are several emerging issues that will impact WE over the next reporting cycle. Some issues are general and are a result of the economy and responding to a change in workforce culture. However, WE must also respond to changes in local, state, and federal laws. This section will discuss emerging issues that will be addressed during the next reporting cycle. The section is organized into two subsections, 6.1, General; and 6.2, Water Quality.

6.1 General

This section will include a discussion of:

- inflation and supply chain;
- workforce challenges;
- electrification of vehicle fleet;
- impacts of COVID policies and protocols; and
- obsolete equipment/technology.

6.1.1 Inflation and Supply Chain

Over the past 2 years, the COVID-19 pandemic has resulted in some project construction delays and cost increases due to materials shortages, labor shortages, and shipping delays. Prior to 2020, the SFPUC applied construction escalation factors of 3 to 4 percent compounded annually for estimating future costs of capital projects. However, based on recommendations from professional cost estimating experts, SFPUC has doubled escalation factors through year 2024, and held the escalation factor at 4 percent thereafter. This has raised the estimated capital cost for future projects to accommodate potential future inflationary impacts.

Capital projects have experienced schedule delays due to impacts to product manufacturing, shipping, and availability of raw materials. In general, steel items and many electronics parts experienced significant delays, likely due to pandemic-related factory closures and production delays. Contractors complained of increasing costs for materials, especially on multi-year contracts. SFPUC held contractors to their bid prices; however, for change orders, the higher (more current) cost of materials was typically compensated. In addition, compensation was provided for contractors' implementation of health and safety plans directly related to the pandemic. Although most construction delays related to supply chain have been deemed excusable but noncompensable, these delays have increased soft costs on projects, delayed projects' close-out, and impacted staff availability for new projects.

Cost estimating consultants advising SFPUC shared that higher cost escalation in construction will likely continue for the next several years due to various interrelated factors, including time that will be required to resolve the supply chain crisis; shortage of labor nationwide, including skilled labor and management; international sanctions from the current war in Ukraine; recent passage of the Infrastructure Bill, which will increase construction activity and demand for labor and materials; and a higher Consumer Price Index that is projected by several industry experts over the next few years.

6.1.2 Workforce Challenges

WE has experienced an increased number of resignations and retirements during the reporting cycle. For some WE divisions, the attrition rate for the reporting cycle has nearly doubled when compared to the previous 2-year period. This has significantly impacted operations and backlogged recruiting efforts. Four primary factors drove the unprecedented increase in separations: (1) the vaccination mandate; (2) return to worksite requirements; (3) competing companies' incentives (e.g., fulltime telecommuting, compensation, and rapid hiring processes); and (4) housing issues (the Bay Area cost of housing and the availability of housing in remote locations like Moccasin). To combat falling staffing levels, SFPUC has elevated its employee attraction efforts by (1) increasing our advertising efforts; (2) partnering with consulting firms to improve racial equity and inclusion initiatives to widen the candidate pool; and (3) conducting multiple virtual job fairs. These efforts have provided some gain in achieving pre-COVID staffing levels; however, positions that have been "difficult to fill" (e.g., engineers, skilled trades) have become even more difficult to fill over the past 2 years.

6.1.3 Electrification of Vehicle Fleet

In May 2017, the SFBOS approved ordinance 115-17, amending the existing Administrative and Environmental Codes to require that any new passenger vehicle procured for the CCSF fleet be a zero emission vehicle, absent of a waiver, and that all passenger vehicles in the CCSF fleet be zero emission vehicles by December 31, 2022; and to encourage selection of zero emission vehicles in other classes as technology improves.

SFPUC's passenger vehicle fleet consists of 66 vehicles, of which two are compliant with the ordinance, 27 are considered low emission (hybrid, compressed natural gas), and the remainder are traditional combustion engine. SFPUC will be filing a waiver to come into compliance with the ordinance.

Before purchasing more EVs, SFPUC needs to understand how to transition to electrifying its business fleet. Challenges range from suitability for SFPUC's operations to maintaining the EVs and charging infrastructure. SFPUC will be evaluating this challenge over the next reporting cycle for passenger vehicles and half-ton trucks.

6.1.4 Impacts of COVID Policies and Protocols

After two and a half years, COVID continues to impact the workforce. Over the last reporting cycle, SFPUC was required to rebalance its budget to cope with the economic impacts of COVID, and continued to successfully provide essential services to the public, maintain financial sustainability, and preserving reserves for the longer term. As SFPUC enters a new stage of managing COVID, new challenges continue to impact productivity, including the need to define a new normal and transition the workforce.

Complying with COVID-related requirements continues to be a challenge as the guidance and internal procedures are updated on a regular basis to reflect the current status of the pandemic, health orders, California Occupational Safety and Health Administration regulations, and policy directives issued by the Department of Human Resources. Areas of impact include communication challenges and productivity of frontline workers.

Communicating changes has been a challenge, specifically because a large portion of the field staff has limited access to email or no internet access. In some cases, continual changes have led to mistrust amongst staff because individuals are unclear as to what the current policy is. SFPUC will continue to work on communication methods to keep staff informed, and will continue to prioritize the health, safety, and well-being of employees.

COVID continues to impact productivity. Scheduling around COVID, and the resulting increase in personnel vacancies, is impacting scheduling efficiency. COVID-related staffing shortfalls have made crew availability (the number of employees available to support a job) less predictable. This negatively impacts SFPUC's ability to effectively schedule and complete PM jobs in a timely manner. It has also negatively impacted SFPUC's ability to support project work, ultimately causing project completion delays. This is even more acute on multi-discipline work orders, with two or more crafts supporting maintenance and/or project work. For example, the O'Shaughnessy Dam Grounding Project involved multiple HHWP crews (electricians, laborers, carpenters, Project Managers, power system operators, linemen, and engineering). Due to crew availability shortfalls and supply chain issues (resulting from COVID), this project's completion was delayed for nearly a year. Though it is not possible to control the impacts of COVID, SFPUC can affect vacancies. WE continues to make recruiting and hiring a priority.

SFPUC remains committed to rebuilding trust, work engagement, and a culture of unity within our enterprise by monitoring morale, workplace stress, and providing additional support when needed.

6.1.5 Obsolete Equipment/Technology

SFPUC is experiencing a fairly new phenomenon with some of our equipment and is hearing similar concerns from other water utilities: equipment is becoming obsolete in 10 to 15 years, and manufacturers are not carrying parts for older models. In the past, it was not uncommon for equipment used in water treatment and delivery to be in service for 30 years or longer, and parts for older models continued to be made available by manufacturers even when newer models came on the market. In 2020, one of the UV reactors at the Thomas Shaft Backup Chlorination Facility needed new UV lamp wipers and some seals replaced. The UV system provider had stopped carrying replacement parts for that reactor model. The UV reactors were installed in 2011, about 9 years earlier. Parts that would have cost a few hundred dollars and less than a week of labor to replace became an estimated $200,000 project to be completed by a JOC, with a cost of $120,000 for the new UV reactors alone. This project is currently on hold pending further discussion with LLNL.

The issue is not isolated to UV reactors. Similar problems have surfaced for ultrasonic flowmeters, automatic transfer switches, VFDs, UPS units, and generator load banks, to name a few. The impact of this trend of the manufacturers ceasing to carry repair parts and supporting for equipment that is nowhere near the end of its service life is effectively a substantial reduction in asset useful life. This is a developing situation with significant ramifications. If this trend continues, SFPUC and other water utilities will have to plan for capital replacement of existing assets to match the rate at which the asset models are retired by the manufacturers, which is approximately three times the current rate. The reliability of the water systems will also be

impacted because capital replacements often must be implemented under capital projects, and capital projects require a much longer execution timeline compared to repair timelines.

6.2 Water Quality

SFPUC continues to monitor water quality issues. This section includes a discussion of:

- disinfection byproducts;
- taste and odor;
- quinoline;
- microplastics; and
- an update on our triennial report, "Other Contaminants of Emerging Concern."

6.2.1 Disinfection Byproducts

SFPUC notifies wholesale customers when elevated DBPs reach 80 percent of the drinking water standards (i.e., MCLs). This corresponds with wholesale customer notifications when total trihalomethanes reach 64 micrograms per liter (µg/L) or haloacetic acids (HAA5) reach 48 µg/L at Irvington Portal or at HTWTP. These levels were not exceeded during the reporting period.

During the reporting cycle, two wholesale customers reported elevated HAA5 levels in their distribution systems in the fourth quarter of 2021. SFPUC measured much lower HAA5 levels in RWS at that time and embarked on a joint investigation with the impacted customers. The joint investigation was concluded when it became apparent that analytical issues at the customer's contract laboratories were likely causing the HAA5 discrepancies.

U.S. EPA's M/DBP Stage 3 proposal is due in June 2024. All current regulations are open to review, including filtration avoidance requirements. The drinking water industry could see new regulations for NDMA, other DBPs, *Legionella*, etc. U.S. EPA is undertaking four grant projects, totaling $8.5 million, to obtain occurrence/treatment/system data. SFPUC has been asked to participate in at least two proposals. SFPUC is also part of the Water Research Foundation (WRF) 5156 *Legionella* occurrence data collection project (meant to inform the M/DBP Stage 3 proposal), with monitoring starting in August 2022. SFPUC's Millbrae Lab has developed internal *Legionella* testing capability for this project.

Taste and Odor

In early December 2016, SFPUC received an unusually high number of T&O complaints from both retail and wholesale customers. The complaints were linked to an algal bloom in San Antonio Reservoir that was producing geosmin, a very common T&O compound. SFPUC has not experienced a major T&O event since 2016. In response to the 2016 event, SFPUC increased the routine T&O compound monitoring program at the SVWTP and initiated two treatment improvement projects for SVWTP: a PAC system and an ozone system. The PAC system construction was completed in December 2018, and it has been used on an as-needed basis depending on available source waters and algal blooms. The ozone project completed its 35% design documents in April 2022 and will soon issue 65% design documents for review. The ozone construction is tentatively set to start in September 2023. Although PAC provides T&O treatment improvements at SVWTP, ozone will provide additional treatment capabilities for removing

more T&O compounds and will provide other water-quality benefits, such as DBP reductions. Future ozone treatment will be a valuable tool for optimizing water quality from the SVWTP during long Hetch Hetchy shutdowns.

WE also updated its Algae Monitoring and Mitigation Plan (AMMP) in June 2019. The AMMP provides a comprehensive review of reservoir limnology, monitoring programs, and algae bloom mitigations. Monitoring and treatment triggers were revised for each source reservoir, and the best tools or strategies for algae bloom management were identified.

6.2.2 Quinoline

U.S. EPA issues a list once every 5 years of no more than 30 unregulated contaminants to be monitored by public water systems under the Unregulated Contaminant Monitoring Rule. The UCMR4 required monitoring in the SFWS, which serves the City of San Francisco, between 2018 and 2020; however, SFPUC voluntarily monitored additional locations in RWS.

SFPUC completed UCMR4 monitoring in January 2019. Quinoline, a semi-volatile organic chemical, was detected at Baden Pump Station (in the SSPL at point-of-entry into the SFWS) and at the outlet at Sunset Reservoir. This chemical was also found at the LMPS.

SFPUC believes that the source of quinoline detections in these locations is coal tar lining (quinoline was not detected in water sources). The detections were localized and appear to be related to pipeline materials/conditions and operational conditions (detention time/flow or temperature). SFPUC's long-term plan is to remove all coal tar lining. Coal tar lining will be removed and replaced during major pipeline maintenance projects, as detailed in Section 4.3.

On a broader level—to assess whether quinoline exists in RWS and whether a quinoline monitoring program is necessary for the SFPUC water supplies—a follow-up, voluntary monitoring event occurred in December 2019. Quinoline was sampled at nine transmission pipeline locations, including four locations where coal tar lining is still present inside the pipelines. In addition, quinoline was sampled at four major Peninsula and East Bay surface water reservoirs, AEP, TTF intake, SVWTP effluent, and HTWTP effluent. The follow-up monitoring did not detect any quinoline at any of these RWS locations; therefore, there is no need to have a quinoline monitoring program for RWS. U.S. EPA now has national occurrence data and will need to decide whether it has enough treatment/health effects data to proceed with a regulatory determination.

6.2.3 Microplastics

In July 2020, SWRCB adopted a definition of microplastics as solid polymeric materials to which chemical additives or other substances may have been added, which are particles that have at least three dimensions that are greater than 1 nanometer and less than 5,000 micrometers (µm). Polymers that are derived in nature and have not been chemically modified (other than by hydrolysis) are excluded. SWRCB will require mandatory 4-year monitoring for these microplastics, possibly starting in 2023. This is an original program globally. SFPUC expects its results to be better than most utilities, given its protected watersheds, but cannot be certain until data are available. The SWRCB resolution adopting the definition of microplastics noted that evidence concerning the toxicity and exposure of humans to microplastics is nascent and rapidly

evolving, and that the proposed definition of "microplastics in drinking water" is subject to change in response to new information. The definition may also change in response to advances in analytical techniques and/or the standardization of analytical methods.

In 2021, SWRCB released a draft Microplastics Monitoring Policy Handbook that proposed monitoring requirements for drinking water systems under a two-phased approach, following ELAP laboratory accreditation. Following public comments, SWRCB has postponed the monitoring requirements until after a pilot phase of monitoring study, which is scheduled to begin in fall 2022. The pilot phase is currently under development, with SWRCB and partners evaluating sampling methods, developing standard protocols, and providing sampling training. SWRCB expects to release a revised Policy Handbook for adoption in the fall. The revised Policy Handbook will include a list of Phase 1 water systems that will required monitoring under orders to be issued after SWRCB has conducted a sampling location workshop. SWRCB is reportedly open for discussions at the workshop on aspects such as consolidating water systems and sampling requirements.

6.2.4 Other Contaminants of Emerging Concern

SFPUC is in process of finalizing its triennial "Contaminants of Emerging Concern Report" update. The report covers DBPs, PFAS, microplastics, and other topics. Draft material was reviewed with wholesale customers and other stakeholders. The final report will be posted on the SFPUC website by October 2022.

Appendix A: Asset Inventory Tables

Table A-1: Dams

Asset	Dam Type	Dam Height (feet)	County	Completion Date	DSOD Jurisdictional?
Upcountry					
O'Shaughnessy Dam	Concrete Gravity Arch	430	Tuolumne	1923/1938	Yes
Cherry Valley Dam	Earth and Rock	330	Tuolumne	1955	Yes
Early Intake Diversion Dam	Concrete Arch	81	Tuolumne	1924	Yes
Eleanor Dam	Concrete Buttressed Arch	70	Tuolumne	1918	Yes
Moccasin Dam	Earth and Rock	70	Tuolumne	1929	Yes
Priest Dam	Earth and Rock	160	Tuolumne	1923	Yes
Moccasin Upper Dam	Concrete-Gravity	30	Tuolumne County	1936	Yes, appurtenance to Moccasin Dam
Bay Area					
Calaveras Dam	Earth and Rock Filled	220	Alameda	1925/2019	Yes
Turner Dam	Earth	195	Alameda	1965	Yes
Upper Alameda Diversion Dam	Concrete Slab and Buttress	31	Alameda	1931	No
Lower Crystal Springs Dam	Concrete Gravity	163	San Mateo	1888/1890/ 1911	Yes
Upper Crystal Springs Dam	Earth	92.5	San Mateo	1877/1891	No
Pilarcitos Dam	Earth	95	San Mateo	1866/1867/ 1874	Yes
San Andreas Dam	Earth	105	San Mateo	1870/1875	Yes
San Mateo Creek Dam No. 1	Earth	20	San Mateo	1898	No
San Mateo Creek Dam No. 2	Concrete Arch	40	San Mateo	1898	No
Stone Dam	Masonry Arch	31	San Mateo	1871	No

Asset	Dam Type	Dam Height (feet)	County	Completion Date	DSOD Jurisdictional?
San Francisco					
Sunset North Dam	Earth	74	San Francisco	1938	Yes
Sunset South Dam	Earth	34	San Francisco	1960	Yes
University Mound North Basin	Earth	17	San Francisco	1885	Yes
University Mound South Basin	Earth	61	San Francisco	1937	Yes
Merced Manor Dam	Earth	23	San Francisco	1936	No

Note:
DSOD = Division of Safety of Dams

Table A-2: Groundwater Wells/Filter Galleries

Asset	Number of Wellheads	Location	Capacity
Bay Area			
Pleasanton Well Field	2	Pleasanton	< 1 mgd
Peninsula Conjunctive Use Wells (2019)	13	Various	~6.2 mgd
Sunol Filter Gallery	—	Sunol	7.4 mgd
Upcountry			
Cherry Valley Compound Well	1	Cherry Valley	3 to 7 gpm
O'Shaughnessy Backpacker Campground Well	1	O'Shaughnessy	6.8 gpm
O'Shaughnessy Dam Campground Well	1	O'Shaughnessy	30 gpm

Notes:
gpm = gallons per minute
mgd = million gallons per day

Table A-3: Supply Reservoirs

Asset	Capacity of Reservoir (AF)	Reservoir Surface Area (sq. mi)	Location
Bay Area			
Calaveras Reservoir	96,800	2.2	Alameda County
San Antonio Reservoir	50,500	1.3	Alameda County
Crystal Springs Reservoir (Upper and Lower)	69,300[4]	2.3	San Mateo County
Pilarcitos Reservoir	3,100	0.2	San Mateo County
San Andreas Reservoir	19,000	0.9	San Mateo County
Upcountry			
Early Intake Reservoir	115		Tuolumne County
Hetch Hetchy Reservoir	360,360[5]	3.1	Tuolumne County
Lake Eleanor	27,113[6]	1.5	Tuolumne County
Lake Lloyd (Cherry Valley Reservoir)	273,500	2.8	Tuolumne County
Moccasin Reservoir	552	0.05	Tuolumne County
Priest Regulating Reservoir	1,706	0.07	Tuolumne County

Notes:

AF = acre-feet
sq. mi = square miles

Table A-4: Treated Water Storage

Asset	Capacity (MG)	Location
Bay Area		
Town of Sunol (two tanks)	0.097 and 0.097	Sunol
Niles Reservoir	Decommissioned	Niles
Castlewood Reservoir	0.4	Pleasanton
Pulgas Balancing Reservoir	60	San Mateo
Merced Manor Reservoir	9.5	San Francisco
Sunset Reservoir – North Basin	89.4	San Francisco
Sunset Reservoir – South Basin	87.3	San Francisco
University Mound Reservoir – North Basin	59.4	San Francisco
University Mound Reservoir – South Basin	81.5	San Francisco
Upcountry		
Moccasin Domestic	0.088	Moccasin
Early Intake Domestic	0.044	Early Intake
Cherry Compound	0.066	Cherry
O'Shaughnessy Domestic	0.041	O'Shaughnessy

Note:

MG = million gallons

[4] 57,704 AF maximum permissible level due to Fountain Thistle.
[5] Capacity with drum gates activated.
[6] Capacity with flashboards.

Table A-5: Water Treatment Facilities

Asset	Capacity (mgd)	Location
Bay Area		
TTF	315	Tracy/San Joaquin County
Thomas Shaft Facility	315	San Joaquin County
SVWTP	160	Alameda County
Sunol Chloramination Facility	–	Alameda County
HTWTP	140[7]	San Mateo County
Pulgas Dechloramination Facility	200	San Mateo County
Upcountry		
Rock River Lime Treatment Plant	400	Tuolumne County
Moccasin Camp UV Facility	0.47 per reactor (2)	Tuolumne County
Early Intake Camp UV Facility	0.47 per reactor (2)	Tuolumne County
O'Shaughnessy Compound UV Facility	0.17 per reactor (2)	Tuolumne County

Notes:

HTWTP = Harry Tracy Water Treatment Plant

mgd = million gallons per day
SVWTP = Sunol Valley Water Treatment Plant
TTF = Tesla Treatment Facility
UV = ultraviolet

[7] Peak hydraulic capacity is 180 mgd for a few hours.

Table A-6: Water Transmission – Pipelines and Tunnels

Asset	Size	Length (miles)	Flowrate (Design or Operating) (mgd)	Installation Date
Bay Area				
CRT	10.5′	25	400	1934
Alameda No. 1	69″	0.6	67	1934
Alameda No. 2	91″	0.6	134	1953
Alameda No. 3	96″	0.6	152	1967
Alameda No. 4	66″	0.6	160	2011
San Antonio Pipeline	60″	2.1	230	1967
SABPL	66″	1.3	230	2014
Calaveras Pipeline	44 to 72″	6	80	1965/1992
Irvington Tunnel No. 1	10.7′	3.5	400	1934
Irvington Tunnel No. 2	102″	3.5	400	2014
BDPL No. 1	60″	21.2	46	1925/1933
BDPL No. 2	66″	21.2	59	1935/1936
BDPL No. 3	72″	34	80	1952
BDPL No. 4	90″	34	80	1965/1967 1973
BDPL No. 5	East Bay: 72″ Peninsula: 60″	7 9	80 55	2011/2012
Bay Tunnel	9′	5	120	2014
Pulgas Tunnel	10.3-foot horseshoe	1.9		1924
Stanford Tunnel	90″	0.2	80	1949
Palo Alto Pipeline	12 to 36″	4.4		1938
Crystal Springs Bypass Tunnel	9.5′	3.4	215	1969
Crystal Springs Bypass Pipeline	96″	0.9	215	1970
New Crystal Springs Bypass Tunnel	96″	0.8	215	2011
SSPL	60″	13.4	111	1948-1958
CSPL No. 1	44″	17.1	10	1885/1956
CSPL No. 2	60″	19.3	52	1937/1956
CSPL No. 3	60″	3.6	60	1971/1987
SAPL No. 1	44″	12.5	22	1870-1939
SAPL No. 2	54″	12.3	37	1927-1928 2020
SAPL No. 3	60 to 66″	6.6	65	1992/2014
Sunset Branch Pipeline	60″	1.1	65	1947
Crystal Springs-San Andreas Force main	61″	4.7	90	1898-1932 1968
Stone Dam Tunnel No. 1	4′-6″ by 4′-9″	0.1	45	1872-1948
Stone Dam Tunnel No. 2	3′-6″ by 4′-4″	0.61	45	1872-1948
San Mateo Tunnel No. 1	3′-6″ by 5′-1″	0.65	40	1868
San Mateo Tunnel No. 2	4′-4″ by 4′-6″	0.67	45	1898
Upcountry				

Asset	Size	Length (miles)	Flowrate (Design or Operating) (mgd)	Installation Date
Canyon Power Tunnel	14' by 14'-6" horseshoe	10.8	Design: 471	1965
Cherry Power Tunnel	12' by 12' horseshoe	5.5	Design: 523	1959
Early Intake Bypass	14' by 14'-6" horseshoe	0.38	NA	1967
Eleanor-Cherry Tunnel	10'-10" by 10'-10" horseshoe	1.1	Operating: 646	1960
Foothill Division Tunnel	13'-4" by 14'-3" horseshoe	16.4	400	1929
LCA		3.78	Operating: 107	1917
Moccasin Power Tunnel	13' by 13' horseshoe	1	Design: 801	1925
Moccasin Reservoir Bypass Pipeline	108"	0.39	Operating: 320	1972/1988
Mountain Division Tunnel	varies	19.2	Design: 400 at grade of 1.55:1000	1925
Red Mountain Bar Siphon	9.5'	0.48	400	1970
SJPL No. 1	56 to 72"	47.4	Operating: 75	1932
SJPL No. 2	61"	47.4	Operating: 80	1952
SJPL No. 3	78"	47.4	Operating: 150	1968
SJPL No. 4	78"	17.2	Operating: 150	2011-2013

Notes:

BDPL = Bay Division Pipeline
CRT = Coast Range Tunnel
CSPL = Crystal Springs Pipeline
LCA = Lower Cherry Aqueduct
mgd = million gallons per day
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SJPL = San Joaquin Pipeline
SSPL = Sunset Supply Pipeline

Table A-7: Water Transmission – Pump Stations

Asset	Number of Pumps	Total Capacity (mgd)	Location
Bay Area			
LMPS	5	65	San Francisco
Baden Pump Station	3	45	San Bruno
CSPS	4	120	San Mateo
Town of Sunol (potable)	2	0.72	Sunol
Sunol Pump Station	3	7.4	Sunol
Pulgas Pump Station	5	185	San Mateo
SAPS	8 (electric) 2 (diesel)	160	Sunol
Upcountry			
Cherry-Eleanor Pump Station	10	300	Tuolumne County

Notes:

CSPS = Crystal Springs Pump Station
mgd = million gallons per day
LMPS = Lake Merced Pump Station
SAPS = San Antonio Pump Station

Table A-8: Water Transmission – Valve Lots

Asset	Valves	Valve Size (inches)	Pipeline	Location
Bay Area				
Alameda Creek	V8	36 by 60	ACDD	Sunol
	V10	60 by 84	ACDD	
	V11	60 by 84	ACDD	
	V12	36 by 60	ACDD	
	V13	36 by 60	ACDD	
	V18	60 by 72	ACDD	
	V20	60 by 72	ACDD	
	V220	60 by 72	ACDD	
	V240	60 by 72	ACDD	
AEP	X10	72	AS-2	Sunol
	X20	72	AS-3	
	X30	60	AS-1	
	X32	60	AS-1	
	X50	54	AS-4	
	X55	54	AS-4	
Alameda +SAPL + SABPL	W35	60	SAPL	Sunol
	W41	60	SABPL	
	W42Y	60	SABPL	
	X15	90	AS-2	
	X23	66	SABPL	
	X24Y	66	SABPL	
	X25	72	SABPL	
	X35	66	AS-1	
	X64	12	SUNOL PL	
	X71	96	AS-4	
	X72	96	AS-1	
	X73	84	AS-2	
	X74	84	AS-1	
	X75	96	AS-3	
	X76	96	AS-1	
	Y20	54	SAPL	
	Y21	54	SAPL	
	Y22	48	SAPL	
	Y23	60	SAPL	
	Y24	60	SABPL	
	Y25	66	SABPL	
	Y27	66	SABPL	
	Y28	54	SABPL	
	Y30	30	SAPL	
	Y31	24	SAPL	
	Y32	36	SAPL	
	Y35	36	SAPL	
	Y41	20	SAPL	
	Y42	20	SAPL	
	Y43	24	SAPL	
	Y44	36	SAPL	

Asset	Valves	Valve Size (inches)	Pipeline	Location
AWP	X61	12	TOSPL	Sunol
	X62	12	TOSPL	
	X63	12	TOSPL	
	X85	72	AS-2	
	X95	96	AS-4	
Baden Valve Lot	K50	42	CSPL No. 2	South San Francisco
	K51M	36	CSPL No. 2	
	K54P	42	CSPL No. 2/SSPL	
	K54R	30	CSPL No. 2	
	M50	60	SSPL	
	M53R	30	SSPL/SAPL No. 2	
	M54P	42	SAPL No. 1	
	M55P	42	SAPL No. 1/CSPL No. 2	
	P57M	30	SAPL No. 1	
	P57R	42	CSPL No. 2	
	P59R	42	CSPL No. 2	
	R50	42	SAPL No. 2	
	R55	54	SAPL No. 2	
	R55K	36	SAPL No. 2/SAPL No. 3	
	R58P	42	SAPL No. 2/CSPL No. 2	
	T50	48	SAPL No. 3	
	T52R	42	SAPL No. 2/SAPL No. 3	
	T54M	42	SAPL No. 2/SAPL No. 3	
	T55	54	SAPL No. 3	
	T55P	16	CSPL No. 2/SAPL No. 3	
	T56R	42	SAPL No. 2/SAPL No. 3	
	T57P	42	CSPL No. 2	
	T58K	24	CSPL No. 2/SAPL No. 3	
Barron Creek	C34	72	BDPL No. 3	Palo Alto
	C36	72	BDPL No. 3	
	C35D	42	BDPL No. 3/BDPL No. 4	
	D34	90	BDPL No. 4	
	D36	90	BDPL No. 4	
Bear Gulch Valve Lot	C58	72	BDPL No. 3	Atherton
	C60	72	BDPL No. 3	
	D58	84	BDPL No. 4	
	D60	84	BDPL No. 4	
	C59D	42	BDPL No. 3/BDPL No. 4	
Bellevue and Pepper Valve Lot	M30	42	SSPL	Hillsborough
	M31	36	SSPL	
	M32K	36	CSPL No. 2/SSPL	
	M33L	36	CSPL No. 3/SSPL	
	L30	42	CSPL No. 3	
Calaveras Valve Lot	C20	66	BDPL No. 3	Milpitas
	C22D	48	BDPL No. 3/BDPL No. 4	
	C23D	48	BDPL No. 3/BDPL No. 4	
	D20	72	BDPL No. 4	

Asset	Valves	Valve Size (inches)	Pipeline	Location
Calaveras Reservoir	V21	30	Calaveras Dam	Sunol
	V22	48	Calaveras Dam	
	V23	48	Calaveras Dam	
	V24	60	Calaveras Dam	
	V25	30	Calaveras Dam	
	V26	48	Calaveras Dam	
	V27	48	Calaveras Dam	
	V31	72	Calaveras Dam	
	V33	72	Calaveras Dam	
	V34	48	Calaveras Dam	
	V36	30	Calaveras Dam	
	V37	30 by 16	Calaveras Dam	
	V38	30 by 16	Calaveras Dam	
	V330	42	CALPL	
	V397	66	CALPL	
	V40	66	CALPL	
	V41	16	CALPL	
	V41A	16	CALPL	
	V41B	16	CALPL	
	V42	66	CALPL	
	V43	36	CALPL	
	V43A	36	CALPL	
	V43B	36	CALPL	
	V44	66	CALPL	
	V442	66	CALPL	
Crystal Springs/San Andreas	S49	36 by 48	CSPL/SAPL	San Bruno
Capuchino Valve Lot	M41	24	SSBPL	San Bruno
	M41A	24	SSBPL	
	M41C	24	SSBPL	
	M43	14	SSBPL	
	M43A	14	SSBPL	
	M43C	14	SSBPL	
Casey Quarry	M20	42	SSPL	Hillsborough
Crawford Valve Lot	C17	78	BDPL No. 3	Fremont
	C18D	42	BDPL No. 3/BDPL No. 4	
	C19	78	BDPL No. 3	
	D17	78	BDPL No. 4	
	D19	78	BDPL No. 4	

Asset	Valves	Valve Size (inches)	Pipeline	Location
Crystal Springs Reservoir	H10	42	LCS Outlet PL	Crystal Spring
	H11	42	LCS Outlet PL	
	H12	42	LCS Outlet PL	
	H20	42	LCS Outlet PL	
	H21	42	LCS Outlet PL	
	H22	42	LCS Outlet PL	
	H88	16	LCS Outlet PL	
	H88A	16	LCS Outlet PL	
	H89	60	CSPL/SAPL	
	H90	16	LCS Outlet PL	
	H91	66 by 60	DSOD Emerg.	
	H92	66 by 60	DSOD Emerg.	
	H93	24	LCS Outlet PL	
	H96	24	LCS Outlet PL	
	J61K	24	CSPL No. 1/CSPL No. 2	
	J62K	24	CSPL No. 1/CSPL No. 2	
	K60	48	CSPL No. 2	
	K70	48	CSPL No. 2	
	L40P	30	CSPL No. 3/Millbrae Yard	
	L41K	42	CSPL No. 3/Millbrae Yard	
	L59K	44	CSPL No. 2/CSPL No. 3	
	L60	44	CSPL No. 1	
	L70	44	CSPL No. 1	
Crystal Springs and El Cerrito Valve Lot	K20	48	CSPL No. 2	Hillsborough
Davis Tunnel Diversion	S20	56 by 52	Davis Tunnel	
Edgewood Road Valve Lot	A64D	24	BDPL No. 1/BDPL No. 4	San Mateo
	B65D	24	BDPL No. 2/BDPL No. 4	
	B66C	20	BDPL No. 2/BDPL No. 3	
Burlingame Valve Lot	K30	36	CSPL No. 2	Burlingame
El Camino Real/ Millbrae Yard Valve Lot	K38P	16	CSPL No. 2	Millbrae
	K39P	16	SAPL No. 1	
	K40	30	CSPL No. 2	
	K40P	12	CSPL No. 2	
	K41P	12	CSPL No. 2	
	M40	42	SSPL	
	M42K	36	SSPL/CSPL No. 2	
Grimmer Shutoff Station	A17	66	BDPL No. 2	Hayward
	A18	66	BDPL No. 2	
	A19	66	BDPL No. 2	
	A191	36	BDPL No. 2	
	A19B	36	BDPL No. 1/BDPL No. 2	
	A19E	24	BDPL No. 2/BDPL No. 5	
	A23B	24	BDPL No. 1/BDPL No. 2	
	B17	60	BDPL No. 1	
	B18	60	BDPL No. 1	
	E15A	42	BDPL No. 2/BDPL No. 5	

Asset	Valves	Valve Size (inches)	Pipeline	Location
Guadalupe Valve Lot	C24 C26 C25D D24 D26	72 72 42 90 90	BDPL No. 3 BDPL No. 3 BDPL No. 3/BDPL No. 4 BDPL No. 4 BDPL No. 4	Santa Clara
HTWTP	T10R T11 T12 T20	54 66 20 42	SAPL No. 3 SAPL No. 3 SAPL No. 3 SAPL No. 3	San Bruno
Hillsborough Valve Lot	M15 M21K M22J	78 36 36	SSPL CSPL No. 2/SSPL CSPL No. 2/SSPL	Hillsborough
Irvington Portal	A09 A10 B10 C10 D10	16 66 60 60 72	Hayward Serv. BDPL No. 2 BDPL No. 1 BDPL No. 3 BDPL No. 4	Hayward
Hayward/EBMUD Intertie	A21 A22 A23 A24	42 36 36 36	Hayward Intertie Hayward Intertie Hayward Intertie Hayward Intertie	Hayward
New Irvington Portal	A11 A11.1 A13E B11 C11 D11 E10 E11 H1 H2 H3 IT2-1	60 16 24 60 78 96 72 72 24 24 24 96	BDPL No. 2 Hayward Pipeline BDPL No. 2/BDPL No. 5 BDPL No. 1 BDPL No. 3 BDPL No. 4 BDPL No. 2 BDPL No. 5 Hayward Pipeline NIT No. 1 Manifold NIT No. 1 to Hayward Pipeline IT2	Fremont (NIT)
Mountain View/ Alviso Valve Lot	C30 C31D C32D D30	42 48 48 72	BDPL No. 3 BDPL No. 3/BDPL No. 4 BDPL No. 3/BDPL No. 4 BDPL No. 4	Mountain View
Newark Tunnel Shaft	A20U B20U E15 E20U	66 60 72 72	BDPL No. 2/BDPL No. 5 BDPL No. 1/BDPL No. 5 BDPL No. 5 BDPL No. 5	Fremont
Palo Alto Pipeline	F40 F45 F50	36 36 24	PAPL PAPL PAPL	Palo Alto

Asset	Valves	Valve Size (inches)	Pipeline	Location
Paseo Padre Shutoff Station	A14	66	BDPL No. 2	Hayward
	A15	66	BDPL No. 2	
	A161	36	BDPL No. 2	
	A16B	36	BDPL No. 1/BDPL No. 2	
	B14	60	BDPL No. 1	
	B15	60	BDPL No. 1	
	E14	72	BDPL No. 5	
	E14A	42	BDPL No. 2/BDPL No. 5	
Pilarcitos Reservoir	S10	22	PIL	Pilarcitos
	S11	26 by 36	PIL	
	S12	26 by 36	PIL	
Ravenswood Tunnel Shaft	B50U	66	BDPL No. 5	Fremont
	E50U	60	BDPL No. 5	
	E52B	24	BDPL No. 2/BDPL No. 5	
Redwood City Valve Lot	A50U	60	BDPL No. 5	East Palo Alto Redwood City
	A60	42	BDPL No. 1	
	A61B	30	BDPL No. 1/BDPL No. 2	
	A62B	30	BDPL No. 1/BDPL No. 2	
	B60	66	BDPL No. 2	
	B62	48	BDPL No. 2	
	E10F	24	PAPL	
	E60	60	BDPL No. 5	
	E61B	42	BDPL No. 2/BDPL No. 5	
	E61	60	BDPL No. 5	
	F05	24	BDPL No. 1/BDPL No. 2	
	F06	24	PAPL	
	F10	20	PAPL	
	F20	20	PAPL	
	F26	24	PAPL	
	F30	30	PAPL	
Crystal Springs Bypass Tunnel/ Bypass Pipeline	G10	120 by 96	Pulgas Tunnel	San Mateo
	G11	120 by 120	Pulgas Tunnel	
	G12	42	Pulgas PS	
	G13	42	Pulgas PS	
	G14	42	Pulgas PS	
	G15	42	Pulgas PS	
	G16	48 by 48	Pulgas PS	
	G17	48 by 48	Pulgas PS	
	G18	84	Pulgas Balancing Res.	
	G18A	18	Pulgas Balancing Res.	
	G20	120 by 120	CSBT	
	G32	96	NCSBT	
	G34	96	CSBPL	
	G36	78	NCSBT/SSPL	
	G38	60	NCSBPL/CSPL No. 2	
	G40	72	CSBPL/SSPL and CSPL No. 2	
	G41	54	CSBPL/SSPL	
	G42	42	CSBPL/CSPL No. 2	

Asset	Valves	Valve Size (inches)	Pipeline	Location
CSPS	H81	72	CSOS No. 1	San Mateo
	H82	72	CSOS No. 1	
	H83	60	CSPS- CSPL/SAPL	
	H84	60	Reservoir – Potable Pipeline	
	H85	60	CSPS Suction	
	H86	36	CSPS Disc. to	
	H87	72	Potable Pipeline	
	H97	42	SSPL	
	H98	42	SSPL	
	H99	42	SSPL	
	J10	12	CSPL No. 2	
	J11	12	CSPL No. 2	
	K10	60	CSPL No. 2	
	M10	60	SSPL	
San Andreas Reservoir	N20	54	SAPL No. 2RW	San Bruno
	N21	54	SAPL No. 2RW	
	N30	48	SAPL No. 3RW	
	N31	48	SAPL No. 3RW	
	N32	48	SAPL No. 3RW	
	N33	48	SAPL No. 3RW	
	N40	54	SAPL No. 2	
	N41	60	SAPL No. 3RW	
	N50	54	SAPL No. 3RW	
	N51	60	SAPL No. 3RW	
	N69	96	HTWTP Treated Water	
	N72	96	HTWTP Treated Water	
	N74	78	SSBPL	
	P10	24	SAPL No. 1	
	P48	44	SAPL No. 1	
	R11	54	SAPL No. 2	
	R12	54	SAPL No. 2	
	R20	42	SAPL No. 2	
	R70	54	SAPL No. 2	
	R71	54	SAPL No. 2	
	T64R	36	SAPL No. 2/No. 3	
	T65R	36	SAPL No. 2/No. 3	
	T70	36	SAPL No. 3	
Pulgas Valve Lot	A68	42	BDPL No. 1	San Mateo
	A70	42	BDPL No. 1	
	B68	42	BDPL No. 2	
	B70	42	BDPL No. 2	
	C68	48	BDPL No. 3	
	C70	48	BDPL No. 3	
	D68	72	BDPL No. 4	
	D70	72	BDPL No. 4	
	E68	60	BDPL No. 5	
	E70	60	BDPL No. 5	

Asset	Valves	Valve Size (inches)	Pipeline	Location
SAPS Valve Lot	X11	20	SVWTP Eff.	Sunol
	X111	20	SVWTP Eff.	
	X112	20	SVWTP Eff.	
	X12	60	SVWTP Eff.	
	X14	66	AS-2	
	X22	60	SVWTP Eff.	
	W11	54	CALPL	
	W12	66	CALPL	
	W15	36	San Antonio Pipeline	
	W20	60	SVWTP Eff.	
	W21	54	SVWTP Eff.	
	W22	54	SVWTP Eff.	
	W30	60	San Antonio Pipeline	
	W31	42	San Antonio Pipeline	
	W32	60	San Antonio Pipeline	
	W33	60	San Antonio Pipeline	
San Antonio Reservoir	Y01	36	San Antonio Pipeline	Sunol
	Y02	36	San Antonio Pipeline	
	Y03	36	San Antonio Pipeline	
	Y04	36	San Antonio Pipeline	
	Y05	36	San Antonio Pipeline	
San Mateo Creek Dam	S13	36 by 36	San Mateo Tunnel No. 1	
	S30	36 by 36	San Mateo Tunnel No. 2	
	S31	39 by 18	San Mateo Tunnel No. 2	
	S32	39 by 18	San Mateo Tunnel No. 2	
	S33	39 by 18	San Mateo Tunnel No. 2	
	S40	30	San Mateo Tunnel No. 2	
San Pedro Valve Lot	M60	42	SSPL	Colma
	T60	48	SAPL No. 3	
	T61M	36	SAPL No. 3/SSPL	
	T62R	30	SAPL No. 3/SAPL No. 2	
	T63R	30	SAPL No. 3/SAPL No. 2	
	T64M	36	SAPL No. 3/SSPL	
	R59	42	SAPL No. 2	
	R60	42	SAPL No. 2	
Stanford East Portal	C40	48	BDPL No. 3	Palo Alto
	D40	72	BDPL No. 4	
SFWD/Valley Water	C23.1	42	BDPL No. 3	Santa Clara
	C23.2	42	BDPL No. 3	
	C23.3	42	BDPL No. 3/BDPL No. 4	
	D23.1	42	BDPL No. 4	
	D23.2	42	BDPL No. 4	
Stanford West Portal	C50	48	BDPL No. 3	Palo Alto
	D50	72	BDPL No. 4	
Stone Dam	S60	22	Stone Dam	Stone Dam
	S61	48 by 48	Stone Dam	
Sunset Branch Pipeline	N44	78	SSBPL	San Bruno
	N75	78	SSBPL	

Asset	Valves	Valve Size (inches)	Pipeline	Location
SVWTP	W10 W40	42 60	CALPL San Antonio PL	Sunol
Tissiack Valve Lot	C14 D14 C15D C16 D16	78 78 42 78 78	BDPL No. 3 BDPL No. 4 BDPL No. 3/BDPL No. 4 BDPL No. 3 BDPL No. 4	Fremont
Upcountry				
Canyon Portal Valve House	CPVH BFV	96	KPH Penstock	Early Intake
Eleanor Release Valves	SG 1 SG 2 G 3 G 4	24 24 24 24	Eleanor Creek	Eleanor
Early Intake Dam	SG 1 SG 2	36 36	Tuolumne River	Early Intake
Cherry-Eleanor Tunnel	SG A SG B	72 by 96 72 by 96	Cherry-Eleanor Tunnel	Cherry Pump Station
Mountain Tunnel Headgates	HG 2 HG 3 HG 4	48 by 60 48 by 60 48 by 60	Mountain Tunnel	Early Intake
Cherry Valley Dam	FCV 1 FCV 2 JFV 1 JFV 2 12-inch Needle BFV 1 BFV 2	66 66 18 18 12 84 84	Cherry Creek	Cherry Valve House
	BFV 3	84	Cherry Power Tunnel	
Emery Crossover Valves	EC-EXO101 EC-EXO201 EC-EXO301 EC-EXO102 EC-EXO202 EC-EXO302 EC-EXOUX12 EC-EXOUX23 EC-EXODX12 EC-EXODX23	60 60 72 60 60 72 36 42 30 36	SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL Nos. 1 and 2 SJPL Nos. 2 and 3 SJPL Nos. 1 and 2 SJPL Nos. 2 and 3	Stanislaus County
Granite Portal Valve House	BFV	94	HPH Penstock	Tuolumne County
Oakdale Portal Valve House	ODP101 ODP201 ODP301 ODP401	60 60 78 78	SJPL No. 1 SJPL No. 2 SJPL No. 3 SJPL No. 4	Tuolumne County

Asset	Valves	Valve Size (inches)	Pipeline	Location
O'Shaughnessy Dam	V1	72	Tuolumne River	O'Shaughnessy Dam
	V2	75	Canyon Power Tunnel	
	V3 through V8	60		
	V12 and V13	36		
	V15 and V16	60		
West Portal Valve House	BFV 1 and BFV 2	104	Moccasin Penstock	West Portal
Pelican Crossover Valves	PC-PXO101	60	SJPL No. 1	Vernalis
	PC-PXO201	60	SJPL No. 2	
	PC-PXO301	72	SJPL No. 3	
	PC-PXO102	60	SJPL No. 1	
	PC-PXO202	60	SJPL No. 2	
	PC-PXO302	72	SJPL No. 3	
	PC-PXO402	72	SJPL No. 4	
	PC-PXOUX12	36	SJPL Nos. 1 and 2	
	PC-PXOUX23	42	SJPL Nos. 2 and 3	
	PC-PXODX12	30	SJPL Nos. 1 and 2	
	PC-PXODX23	36	SJPL Nos. 2 and 3	
	PC-PXODX34	36	SJPL Nos. 3 and 4	
Roselle Crossover Valves	RC-RXO101	60	SJPL No. 1	Riverbank
	RC-RXO201	60	SJPL No. 2	
	RC-RXO301	72	SJPL No. 3	
	RC-RXO102	60	SJPL No. 1	
	RC-RXO202	60	SJPL No. 2	
	RC-RXO302	72	SJPL No. 3	
	RC-RXOUX12	36	SJPL Nos. 1 and 2	
	RC-RXOUX23	42	SJPL Nos. 2 and 3	
	RC-RXODX12	30	SJPL Nos. 1 and 2	
	RC-RXODX23	36	SJPL Nos. 2 and 3	
SJPL No. 4 Tie-In Vault	P4J301	60	SJPL No. 3	Stanislaus County
	P4J401	60	SJPL No. 4	
SJPL Nos. 3 and 4 Throttling Station	T3E331	36	SJPL No. 3	Stanislaus County
	T3E301	72	SJPL No. 3	
	T4E431	36	SJPL No. 4	
	T4E401	72	SJPL No. 4	
SJPL No. 2 Throttling Station T2E	T2E201	48	SJPL No. 2	Stanislaus County
	T2E231	30	SJPL No. 2	
SJPL No. 2 Throttling Station T2W	T2W201	48	SJPL No. 2	Stanislaus County
	T2W231	30	SJPL No. 2	

Asset	Valves	Valve Size (inches)	Pipeline	Location
San Joaquin River Valve House	SJV331	42	SJPL No. 3	Stanislaus County
	SJV311	42	SJPL No. 3	
	SJV212	20	SJPL No. 2	
	SJV231	30	SJPL No. 2	
	SJV211	30	SJPL No. 2	
	SJV131	30	SJPL No. 1	
	SJV112	18	SJPL No. 1	
	SJV113	24	SJPL No. 1	
Tesla UV Valve House	TUV101	60	SJPL No. 1	San Joaquin County
	TUV201	60	SJPL No. 2	
	TUV301	78	SJPL No. 3	
	TUV401	78	SJPL No. 4	
Tesla Portal Valve House	TPV101	60	SJPL No. 1	San Joaquin County
	TPV201	60	SJPL No. 2	
	TPV301	78	SJPL No. 3	

Notes:

ACDD = Alameda Creek Diversion Dam
AEP = Alameda East Portal
AS = Alameda Siphon
AWP = Alameda West Portal
BDPL = Bay Division Pipeline
BFV = butterfly valve
CALPL = Calaveras Pipeline
CSBPL = Crystal Springs Bypass Pipeline
CSBT = Crystal Springs Bypass Tunnel
CSOS = Crystal Springs Outlet Structure
CSPL = Crystal Springs Pipeline
CSPS = Crystal Springs Pump Station
DSOD = Division of Safety of Dams
EBMUD = East Bay Municipal Utility District
HTWTP = Harry Tracy Water Treatment Plant
LCS = Lower Crystal Springs
NCSBPL = New Crystal Springs Bypass Pipeline
NCSBT = New Crystal Springs Bypass Tunnel
NIT = New Irvington Tunnel
PAPL = Palo Alto Pipeline
PIL = Pilarcitos Dam Pipeline
Pulgas PS = Pulgas Pump Station
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SAPS = San Antonio Pump Station
SFWD = San Francisco Water Department
SJPL = San Joaquin Pipeline
SSBPL = Sunset Branch Pipeline
SSPL = Sunset Supply Pipeline
TOSPL = Town of Sunol Pipeline
SVWTP = Sunol Valley Water Treatment Plant
UV = ultraviolet
Valley Water = Santa Clara Valley Water District

Table A-9: Water Transmission – Interties

Asset	Capacity (mgd)	Location
Bay Area		
DWR	50	Sunol
EBMUD	30 mgd to/from EBMUD 15 mgd to/from SFPUC 15 mgd to City of Hayward	Hayward
Valley Water	40	Milpitas

Notes:

DWR = California Department of Water Resources
EBMUD = East Bay Municipal Utility District
mgd = million gallons per day
Valley Water = Santa Clara Valley Water District
SFPUC = San Francisco Public Utilities Commission

Table A-10: Water Transmission – Town of Sunol Distribution System

Asset	Size (inches)	Total Length (miles)	Capacity (mgd)
Bay Area			
Town of Sunol Distribution System	4″ 6″ 8″ 2″	0.75 0.66 0.2 0.7	0.15
Upcountry			
Moccasin Camp	N/A	N/A	N/A
Early Intake Camp	N/A	N/A	N/A
O'Shaughnessy Compound	N/A	N/A	N/A
Cherry Valley Compound	N/A	N/A	N/A

Notes:

mgd = million gallons per day
N/A = not applicable

Table A-11: Watershed and Lands Management – Watersheds

Asset	Size of Hydrologic Watershed (sq. mi)	Area Owned by SFPUC (sq. mi)	Location
Bay Area			
Calaveras Watershed	135	26	Alameda and Santa Clara Counties
Crystal Springs Watershed	24.8	24.8	San Mateo County
Pilarcitos Watershed	6.2	6.1	San Mateo County
San Andreas Watershed	4.1	4.0	San Mateo County
San Antonio Watershed	40	13	Alameda County
Upcountry			
Early Intake Watershed	29	0	Tuolumne County
Hetch Hetchy Watershed	459	0	Tuolumne County
Moccasin Watershed	0	0	Tuolumne County
Lake Eleanor Watershed	79	0	Tuolumne County
Lake Lloyd Watershed	114	0	Tuolumne County
Lower Cherry Diversion Dam Watershed	32	0	Tuolumne County
Priest Watershed	2.8	0	Tuolumne County

Note:
SFPUC = San Francisco Public Utilities Commission
sq. mi = square miles

Table A-12: Powerhouses

Asset	Power Output at Full Reservoir (MW)	Draft (mgd)	Location	Completion Date
Upcountry				
Kirkwood Powerhouse	125	820	Tuolumne County	1964
Moccasin Powerhouse	110	860	Tuolumne County	1925/1969
Moccasin Low Head Powerhouse	2.9	265	Tuolumne County	1986

Notes:
mgd = million gallons per day
MW = megawatt

Table A-13: Penstocks

Asset	Total Length (miles)	Location	Completion Date
Upcountry			
Kirkwood Penstock	0.37	Tuolumne County	1964
Moccasin Penstock	1.1	Tuolumne County	1925/portions in 1969
Moccasin Low Head Penstock	0.5	Tuolumne County	1986

Table A-14: Watershed and Lands Management – Structures (Non-Operations)

Asset	Status	Type	Location
Bay Area			
Cypress Work Center	Active	Former Cottage – now Natural Resources offices, work and meeting center	San Mateo County
Crystal Springs Cottage	Active	Watershed Keeper Residence	San Mateo County
Davis Tunnel Cottage	Active	Watershed Keeper Residence	San Mateo County
North San Andreas Cottage	Active	Watershed Resources Manager Residence	San Mateo County
Pilarcitos Cottage	Active	Watershed Keeper Residence	San Mateo County
Sawyer Camp Cottage	Active	Watershed Keeper Residence	San Mateo County
Upper Crystal Springs Cottage	Active	Watershed Keeper Residence	San Mateo County
Lower Crystal Springs Cottage	Inactive	Watershed Keeper Residence	San Mateo County
San Andreas Cottage	Inactive	Watershed Keeper Residence	San Mateo County
Alameda East Cottage	Active	Watershed Keeper Residence	Alameda County
Andrade Road Cottage	Active	Watershed Keeper Residence	Alameda County
Irvington Cottage	Active	Watershed Keeper Residence	Alameda County
Ohlone Cottage	Active	Watershed Keeper Residence	Alameda County
San Antonio Cottage	Active	Watershed Keeper Residence	Alameda County
Calaveras No. 2 Cottage	Decommissioned	Watershed Keeper Residence	Alameda County
Niles Cottage	Decommissioned	Watershed Keeper Residence	Alameda County
Calaveras No. 1 Cottage	Active	Watershed Keeper Residence	Alameda County
Sunol Yard Cottage	Removed	Watershed Keeper Residence	Alameda County
Tesla Cottage	Active	Operator Residence	San Joaquin County
Polhemus Fluoride Building	Active	Emergency Supply Stockpile and Staging Site	San Mateo County
Mt. Allison	Active	Radio Repeater Site	San Mateo County
Sawyer Ridge	Active	Radio Repeater Site	Alameda County
Pulgas Water Temple	Active	Public Grounds	San Mateo County
Sunol Water Temple	Active	Public Grounds	Alameda County
Upcountry			
O'Shaughnessy Office and cottages	Active	Office, other, residence for HHWP essential personnel and NPS	Tuolumne County
Cherry Cottages and Bunkhouse	Active	Office, residence for HHWP essential personnel, USFS, NPS	Tuolumne County
Early Intake Cottages and Bunkhouse	Active	Office, other, residence for HHWP essential personnel and NPS	Tuolumne County
Lake Eleanor Cottage and Bunkhouse	Active	Office and residence for NPS	Tuolumne County

Asset	Status	Type	Location
Mather Cabins	Active	Other and residence for NPS	Tuolumne County
Moccasin Camp Offices and Cottages	Active	Office, other, residence for HHWP essential personnel	Tuolumne County
Priest Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
Rock River Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
Warnerville Cottages	Active	Residence for HHWP essential personnel	Stanislaus County
West Portal Cottage	Active	Residence for HHWP essential personnel	Tuolumne County
Oakdale Office	Active	Office	Stanislaus County
South Fork Yard Office and Building	Active	Office and shop	Tuolumne County
Warnerville Shops	Active	Office and shop	Stanislaus County
Cherry Creek Diversion Dam Structures	Active	Gatehouse	Tuolumne County
Intake Switchyard Control Building	Active	Power transmission control	Tuolumne County
Warnerville Switchyard Control Building	Active	Power transmission control	Stanislaus County
Holm Powerhouse	Active	Powerhouse	Tuolumne County
Kirkwood Powerhouse	Active	Powerhouse	Tuolumne County
Moccasin Powerhouse	Active	Powerhouse	Tuolumne County
Burnout Ridge Radio Site	Active	Radio Site	Tuolumne County
Duckwall Radio Site	Active	Radio Site	Tuolumne County
Intake Ridge Radio Site	Active	Radio Site	Tuolumne County
Moccasin Peak Radio Site	Active	Radio Site	Tuolumne County
Poopenaut Pass Radio Site	Active	Radio Site	Tuolumne County
Old Moccasin Powerhouse	Not Active	vacant	Tuolumne County
Alameda Valve House	Active	Valve House	Alameda County
Albers Road Valve House	Active	Valve House	Stanislaus County
Canyon Portal Valve House	Active	Valve House	Tuolumne County
Cashman Creek Valve House	Active	Valve House	Stanislaus County
Cherry Valve House	Active	Valve House	Tuolumne County
Emery Road Crossover Auxiliary Control Building	Active	Valve House	Stanislaus County

Asset	Status	Type	Location
Emery Road Crossover Valve House	Active	Valve House	Stanislaus County
Granite Portal Valve House	Active	Valve House	Tuolumne County
Oakdale Portal Valve Houses	Active	Valve House	Stanislaus County
Pelican Crossover Valve House	Active	Valve House	Stanislaus County
Roselle Crossover Valve House	Active	Valve House	Stanislaus County
San Joaquin Valve House	Active	Valve House	Stanislaus County
Tesla Portal Valve Houses	Active	Valve House	San Joaquin County
West Portal Valve House	Active	Valve House	Tuolumne County
Cherry Compound Memocor	Active	Water treatment	Tuolumne County
Early Intake UV Treatment Plant	Active	Water treatment	Tuolumne County
Moccasin UV Treatment Plant	Active	Water treatment	Tuolumne County
O'Shaughnessy UV Treatment Plant	Active	Water treatment	Tuolumne County
Rock River Lime Plant	Active	Water treatment	Tuolumne County
Tesla Chlorination Building	Inactive	Water treatment	San Joaquin County

Notes:

HHWP = Hetch Hetchy Water and Power
NPS = National Park Service
USFS = United States Forest Service
UV = ultraviolet

Table A-15: Buildings and Watersheds – Quarries

Asset	Size (acres)	Location	Purpose
Bay Area			
Casey Quarry	1	San Mateo County	
Skyline Quarry	16	San Mateo County	Emergency Supply Stockpile and Staging
Donovan Quarry	66	Redwood City	Emergency Supply Stockpile

Table A-16: Buildings and Grounds – Corporation Yards

Asset	Size (acres)	Location
Bay Area		
Millbrae Corporation Yard	10	Millbrae
Sunol Corporation Yard	25	Sunol
Rollins Facility	3	Burlingame
Upcountry		
Moccasin	6	Moccasin
South Fork Maintenance Yard	1.5	Tuolumne County
Warnerville Yard	2	Oakdale
Oakdale Yard	NA	Oakdale

Table A-17: Rolling Stock

Asset	Quantity	
	Bay Area	Upcountry
Passenger Cars	20	0
Light Duty Trucks, SUVs, Vans	217	118
Heavy Equipment	31	27
Trailer Equipment, Equipment on Trailers	60	63
Other Equipment – Boats	109	25
Medium and Heavy Duty Trucks	26	20

Appendix B: Emergency Response and Preparedness Plans

Listed below are the relevant ERPs that directly relate to RWS. Plans not listed below include state-level plans, county-level plans, and some division- or bureau-specific contingency plans.

Table B-1: Relevant Emergency Response Plans for the Regional Water System

Plan	Draft/Revision Date	Last Exercised
Regional Water System Emergency Pipeline Repair Recovery and Readiness Program	2004	2015
City and County of San Francisco Emergency Response Plan	2017	2017
Risk Management Plan – California Accident Release Prevention Program for HTWTP	2017	Reviewed July 2018
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Water Treatment Plant	2018	Reviewed July 2018
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Chloramination Facility	2018	Reviewed July 2018
Spill Prevention, Control, and Countermeasure Plan – San Antonio Pump Station	2017	December 2017
Sunol Valley Chloramination Facility and Water Treatment Plant Hazardous Materials Business Plans	2018	October 2016
Water Quality Notifications and Communications Plan (Rev. 7)	2022	June 2018
Water Contamination and Response and Consequence Management Plan	2016	2012
Regional Water System Emergency Disinfection and Recovery Plan	2013	2016
SFPUC EOPs	Overall EOP – 2012 WSTD DEOP – 2013 WQD DEOP – 2016 NRLMD DEOP and FOG – 2014 HHWP DEOP – 2013 CDD DEOP – 2013	WE portion (all divisions) – June 2017 HHWP portion – August 2018 CDD portion – February 2017 WSTD portion – October 2019 WQD portion – April 2016 NRLMD portion – June 2019

Plan	Draft/Revision Date	Last Exercised
SFPUC Continuity of Operations Plan	June 2019	March 2020
Mountain Tunnel Emergency Restoration Plan	2014	March 2017
Emergency Action Plans – DSOD Jurisdictional Bay Area Dams	2017	Turner Dam: May 3, 2017 Calaveras Dam – September 20, 2018
Emergency Action Plans – DSOD Jurisdictional Upcountry Dams	2022	O'Shaughnessy Dam – August 26, 2022 Cherry Valley Dam – August 26, 2022 Lake Eleanor – May 15, 2022 Priest Dam – March 11, 2022 Moccasin Dam – January 12, 2022
Water Quality Division EOP and supplemental Field Operations Guide	2016	2016
Moccasin Overflow Emergency Response Plan – Moccasin Wastewater Treatment Plant	2016 Reviewed March 2018	2018
America's Water Infrastructure Act Drinking Water Utility Risk and Resilience Assessment	2020	N/A
America's Water Infrastructure Act Drinking Water Utility Emergency Response Plan	2020	N/A

Notes:

CDD = City Distribution Division
DEOP = Division Emergency Operations Plan
DSOD = Division of Safety of Dams
EOP = Emergency Operations Plan
HHWP = Hetch Hetchy Water and Power
HTWTP = Harry Tracy Water Treatment Plant
NRLMD = Natural Resources and Lands Management Division
SFPUC = San Francisco Public Utilities Commission
WE = Water Enterprise
WQD = Water Quality Division
WSTD = Water Supply and Treatment Division

Table B-2: Relevant Plans for the Unified Program

Plan	Draft/Revision Date	Last Exercised
Risk Management Plan – California Accident Release Prevention Program for Harry Tracy Water Treatment Plant	2021	2021
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Water Treatment Plant	2018	2021
Risk Management Plan – California Accident Release Prevention Program for Sunol Valley Chloramination Facility/San Antonio Pump Station	2018	2021
Emergency Response Plan – Moccasin Powerhouse and Switchyard	2008	2008
Emergency Response Plan – Moccasin Wastewater Treatment Plant and Water Tanks	2004	2004
Emergency Response Plan – Early Intake	2004	2004
Emergency Response Plan – Rock River Lime Treatment Plant	2004	2004
Emergency Response Plan – Holm Powerhouse, Kirkwood Powerhouse, Early Intake Switchyard, and Fuel Area	2004	2004
Emergency Response Plan – Warnerville Maintenance Yard	2004	2004
Emergency Response Plan – Moccasin Maintenance Yard	2004	2004
Hazardous Communication Program for Hazardous Substances and Pesticides	2019	2019
Fire Prevention Plan – Holm Powerhouse	2004	2004
Fire Prevention Plan – Moccasin and Early Intake	2004	2004
Fire Prevention Plan – Kirkwood Powerhouse, Early Intake Switchyard, and Fuel Area	2004	2004
Sewer System Management Plan – Moccasin	2014	2014
Spill Prevention, Control, and Countermeasure Plan – Moccasin	2019	2019
Spill Prevention, Control, and Countermeasure Plan – South Fork Maintenance Yard	2019	2019
Spill Prevention, Control, and Countermeasure Plan – O'Shaughnessy Dam Maintenance Yard	2019	2019
Spill Prevention, Control, and Countermeasure Plan – Cherry Maintenance Yard	2019	2019

Plan	Draft/Revision Date	Last Exercised
Spill Prevention, Control, and Countermeasure Plan – Warnerville Maintenance Yard and Switchyard	2019	2019
Spill Prevention, Control, and Countermeasure Plan – Baden Pump Station	2021	2021
Spill Prevention, Control, and Countermeasure Plan – Harry Tracy Water Treatment Plant	2021	2021
Spill Prevention, Control, and Countermeasure Plan – San Antonio Pump Station/Sunol Valley Chloramination Facility	2021	2021
Spill Prevention, Control, and Countermeasure Plan – Santa Clara Valley Intertie Pump Station	2021	2021
Spill Prevention, Control, and Countermeasure Plan – Sunol Valley Water Treatment Plant	2021	2021
Spill Prevention, Control, and Countermeasure Plan – Tesla Treatment Facility	2022	2022
Spill Prevention, Control, and Countermeasure Plan – Millbrae Yard	2022	2022
Spill Prevention, Control, and Countermeasure Plan – Sunol Corp Yard	2020	2020
Hazardous Material Business Plan – Rock River Lime Plant	2022	2022
Hazardous Material Business Plan – South Fork Maintenance Yard	2022	2022
Hazardous Material Business Plan – Cherry Valley Compound	2021	2021
Hazardous Material Business Plan – O'Shaughnessy	2021	2021
Hazardous Material Business Plan – Early Intake	2021	2021
Hazardous Material Business Plan – Moccasin	2021	2021
Hazardous Material Business Plan –Warnerville	2022	2022
Hazardous Material Business Plan – Harry Tracy Water Treatment Plant	2022	2022
Hazardous Material Business Plan – Millbrae Maintenance Yard	2022	2020
Hazardous Material Business Plan – Baden Pump Station	2022	2022
Hazardous Material Business Plan – Crystal Springs Pump Station	2022	2022

Plan	Draft/Revision Date	Last Exercised
Hazardous Material Business Plan – Pulgas Dechloramination Facility and Pump Station	2022	2022
Hazardous Material Business Plan – Polhemus Fluoride Station	2022	2022
Hazardous Material Business Plan – Tesla Treatment Facility	2022	2022
Hazardous Material Business Plan – San Antonio Oxygenation Facility	2022	2022
Hazardous Material Business Plan – Sunol Valley Chloramination Facility/San Antonio Pump Station	2022	2022
Hazardous Material Business Plan – Sunol Valley Water Treatment Plant	2022	2022
Hazardous Material Business Plan – Casey Quarry	2022	2022
Hazardous Material Business Plan – Crystal Springs Bypass Tunnel and Shaft	2022	2022
Hazardous Material Business Plan – SFPUC-Valley Water Intertie Pump Station	2022	2022
Hazardous Material Business Plan – Thomas Shaft Facility	2022	2022
Hazardous Material Business Plan – Sunol Corporation Yard	2022	2022
Hazardous Material Business Plan – Calaveras Oxygenation Facility	2022	2022
Hazardous Material Business Plan – Bear Gulch Crossover Facility	2022	2022
Hazardous Material Business Plan – Mt. Alviso Valve Lot	2022	2022
Hazardous Material Business Plan – Calaveras Valve Lot	2022	2022
Hazardous Material Business Plan – Guadalupe Crossover	2022	2022
Hazardous Material Business Plan – Palo Alto (Barron) Valve Lot	2022	2022
Hazardous Material Business Plan – Newark Control Building	2022	2022
Hazardous Material Business Plan – Irvington Portal	2022	2022
Hazardous Material Business Plan – San Pedro Valve Lot	2022	2022
Hazardous Material Business Plan – Ravenswood Control Building	2022	2022

Plan	Draft/Revision Date	Last Exercised
Hazardous Material Business Plan – Alameda East Portal	2022	2022
Hazardous Material Business Plan – Alameda West Portal	2022	2022
Hazardous Material Business Plan – F Street Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Drive Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Serramonte Boulevard Groundwater Treatment Facility	2022	2022
Hazardous Material Business Plan – Hickey Boulevard Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Mission Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Southwood Drive Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Millbrae Yard Well and Treatment Facility	2022	2022
Hazardous Material Business Plan – Sunol Fire Pump Station	2022	2022
Hazardous Material Business Plan – Alameda Creek Diversion Dam Fish Passage Facility	2022	2022
Hazardous Material Business Plan – Pulgas Valve Lot	2022	2022

Notes:

SFPUC = San Francisco Public Utilities Commission

Appendix C: Pipeline Inspection Schedule

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
SAPL No. 2 (Warranty Inspection)	R12 to R20		9/1/2022	2.17	Pipeline	Lock-bar/Steel	2020	54	2	5	0	1.6	5	5	1	
SSPL	M30 to M50		10/1/2022	7.28	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.9	5	1	**23.60**
BDPL No. 4 (PCCP 10-Yr. Recurring Inspection)	D10 to D20	1/1/2013	1/1/2023	8.52	Pipeline	PCCP	1967	96	5	5	2.7	5	4	5	1	
Hillsborough Tunnel and SSPL	M20 to M30		4/1/2023	2.35	Tunnel/Pipeline	Steel	1955-1958	78-90	1	5	3.1	3.5	2.5	5	1	**25.65**
BDPL No. 3 (Railroad Sliplining)	C26 to C40	5/16/2019	9/1/2023		Pipeline	Steel	1952	72-78	1	5	3.2	3.5	3.6	5	1	
BDPL No. 4 (Railroad Sliplining)	D26 to D30	6/1/1996	12/1/2023		Pipeline	Steel	1965-1973	84-96	1	5	2.7	5	3.7	5	1	
BDPL No. 4	D26 to D40	6/1/1996	1/1/2024	12.00	Pipeline	Steel	1965-1973	84-96	1	5	2.7	5	3.7	5	1	
CSPL No. 2	K50 to K70		1/1/2024	6.22	Pipeline	Steel	1937	60	1	5	3.7	2	3	5	1	**24.55**
Palo Alto Pipeline	F6 to F60		1/1/2024	5.36	Pipeline	Steel	1938	36	1	5	3.7	0.1	3.6	5	5	**25.00**
SSPL	M10 to M20		4/1/2024	1.35	Pipeline	Steel	1954-1958	78-90	1	2	3.1	4.5	1.5	5	1	**22.15**
BDPL No. 1	A60 to A70	10/1/2001	4/1/2024	3.97	Pipeline	Steel	1933	60	2	5	3.8	2	3.9	5	1	
SAPL No. 2	R20 to R50		7/1/2024	1.15	Pipeline	Lock-bar/Steel	1927-1928	54	2	5	4	1.6	5	5	1	**29.15**
SAPL No. 2	R60 to CDD		7/1/2024	1.70	Pipeline	Lock-bar/Steel	1927-1928	54	2	5	4	1.6	3.7	5	1	**28.50**
Stanford Tunnel	C40 and D40 to C50 and D50		10/1/2024	0.33	Tunnel	Steel	1952	90	1	3	3.2	4.6		1	5	**24.20**
Crystal Springs Bypass Tunnel (inspect every 10 years)	G20 to G32 and G34	1/1/2011	10/1/2024	3.12	Tunnel	Steel	1970	114	1	4	2.6	5		1	5	
SSPL	M60 to CDD		1/1/2025	1.95	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.7	5	1	**23.50**
Alameda Siphon 2	X10 to X15	2/1/2003	3/19/2025	0.55	Siphon	Steel	1953	90	1	1	3.1	4.5	0.5	5	1	
BDPL No. 3	C50 to C70		4/1/2025	7.84	Pipeline	RCP	1952	72-78	1	5	3.2	3.5	3	5	1	**26.05**
SSPL	M50 to M60	11/1/1999	4/1/2025	3.41	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.6	5	1	

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
CSPL No. 2	K60 to CDD	8/1/2002	7/1/2025	3.68	Pipeline	Steel	1937/1956	60	1	5	3.7	2	3	5	1	
CSPL No. 1	J60 to CDD		7/27/2025	3.86	Pipeline	Steel	1956	44	1	4	3	0.7	3	5	1	**20.05**
SAPL No. 3	T11 to T50		5/1/2026	3.17	Pipeline	Steel	1994	54-60	1	5	2.2	2	5	5	1	**23.30**
San Antonio Pipeline	W20 to Y20	8/4/2016	9/1/2026	2.07	Pipeline	PCCP	1967	60	5	1	2.7	2	0.9	5	1	
Alameda Siphon 3	X20 to X22 and X25	10/13/2016	10/1/2026	0.55	Siphon	PCCP	1967	96	5	1	2.7	5	0.5	5	1	
Balancing Reservoir Pipeline	All	10/1/2005	10/8/2026	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
BDPL No. 3	C20 to C26	3/1/2010	2/1/2027	8.96	Pipeline	Steel	1952	72-78	1	5	3.2	3.5	4.1	5	1	
SAPL No. 3	T50 to T60	3/1/1997	3/9/2027	3.38	Pipeline	Steel	1997	54-60	1	5	2.2	2	4.9	5	1	
San Andreas Raw Water Pipeline 2	N25 to R12	5/1/1994	4/1/2027	0.16	Adit	Steel	2010	72	1	5	1.2	3		4	1	
San Andreas Raw Water Pipeline 3	N35 to N51	5/1/1994	4/1/2027	0.58	Adit	Steel	2010	72	1	5	1.2	3		4	1	
BDPL No. 3	C26 to C40	5/16/2019	6/14/2027	8.19	Pipeline	Steel	1952	72-78	1	5	3.2	3.5	3.6	5	1	
BDPL No. 4	D50 to D68	5/19/2017	10/1/2027	7.86	Pipeline	PCCP	1967	84-96	5	5	2.7	5	3	5	1	
Calaveras Pipeline	V34 to SVWTP		10/1/2027	3.96	Pipeline	Steel	1992	44	1	1	1.8	0.7	4.3	5	1	**14.40**
CSPL No. 3	L30 to L41K	11/16/2017	10/1/2027	3.61	Pipeline	PCCP	1971	60	5	5	2.5	2	2.9	5	1	
CSPL No. 3	P48 to L59K	11/16/2017	10/1/2027	2.54	Pipeline	PCCP	1987	60	5	5	2	2	2.9	5	1	
San Mateo Creek Dam Pipeline and Tunnel 2	All	9/1/2009	1/1/2028	1.61	Tunnel/Pipeline	Steel	1937	48	1	1	3.7	1.1		1	1	
San Antonio Reservoir Pipeline Adit	Intake Structure Control House to Y20		1/1/2028	0.27	Adit	Steel	1967	42	1	1	2.7	0.6		4	1	**12.95**
Pulgas Tunnel	Water Temple to A70, B70, C70, D68 and E70		4/1/2028	2.24	Tunnel	Steel	1967	123	1	2	2.7	5		1	5	**22.55**
Crystal Springs Bypass Pipeline	G34 to G41	6/28/2018	7/1/2028	0.81	Pipeline	PCCP	1970	96	5	2	2.6	5	1.5	5	1	
Crystal Springs Outlet Tunnel 1	H12 to H87	7/1/2005	1/1/2029	0.10	Outlet Tunnel	Steel	1891	44	1	1	5	0.7		4	1	
Crystal Springs Outlet Tunnel 2	H23 to H82	7/1/2005	1/1/2029	0.13	Outlet Tunnel	Steel	1931	54	1	1	3.9	1.6		4	1	
Balancing Reservoir Pipeline	All		7/1/2029	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
CSPL No. 2	K20 to K40	12/1/2006	7/1/2030	5.30	Pipeline	Steel	1937	54-60	1	5	3.7	2	2.9	5	1	
BDPL No. 3	C10 to C20	3/1/2007	10/1/2030	8.55	Pipeline	RCP	1952	72-78	1	5	3.2	3.5	4	5	1	

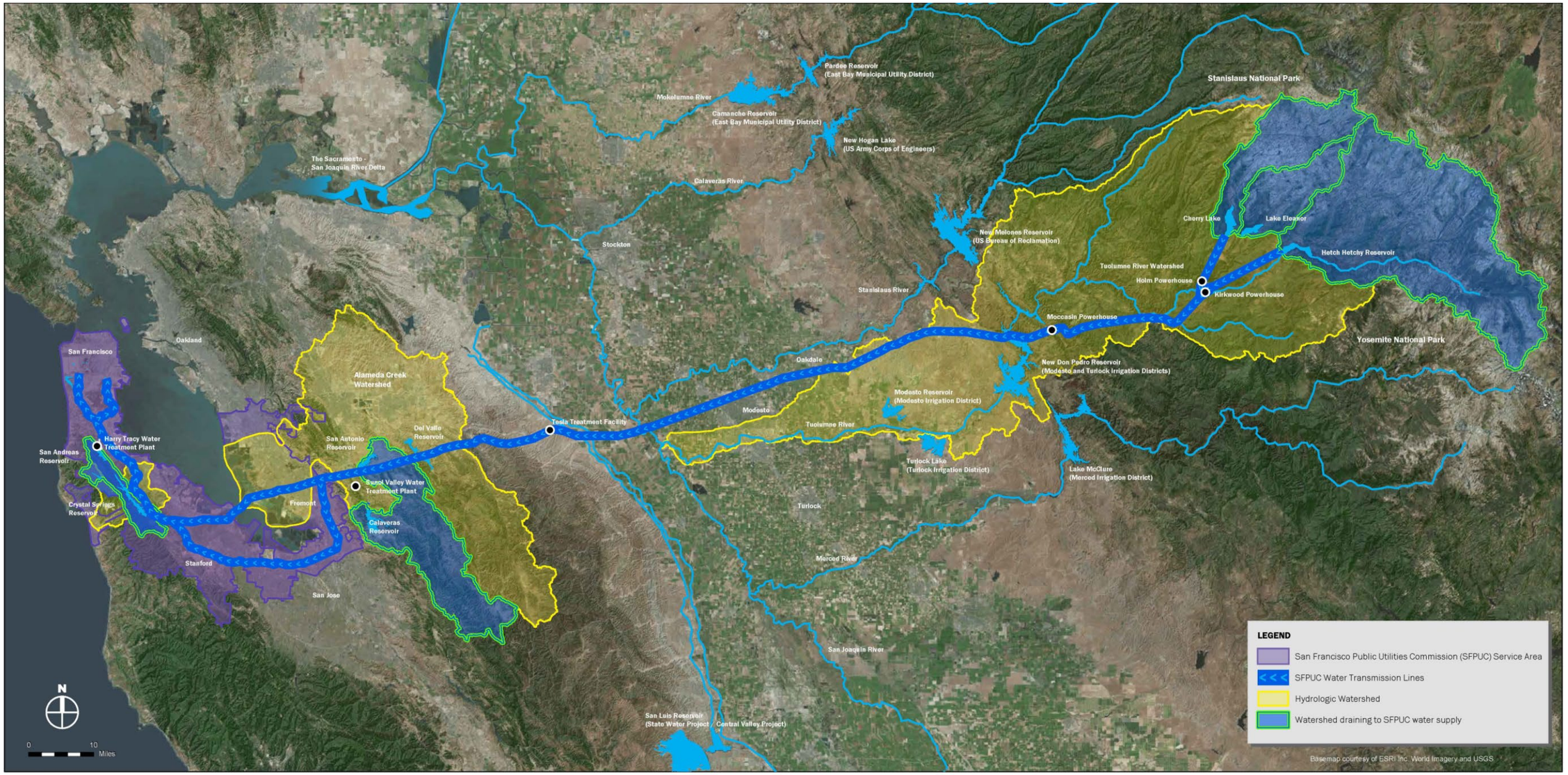
									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
SSPL	M40 to M50	11/1/2007	1/1/2031	3.66	Pipeline	Steel	1954-1958	60	1	5	3.1	2	2.8	5	1	
BDPL No. 1	A50U to A60	3/1/2009	7/1/2031	4.92	Pipeline	Steel	1933	60	1	5	3.8	2	4.1	5	1	
BDPL No. 4	D20 to D30	12/1/2009	7/1/2032	8.96	Pipeline	Steel	1965-1973	84-96	1	5	2.7	5	4.1	5	1	
BDPL No. 3	C20 to C30	3/1/2010	4/1/2033	8.96	Pipeline	Steel	1952	72-78	1	5	3.2	3.5	4.1	5	1	
SAPL No. 2	R50 to R60	6/1/2010	7/1/2033	3.38	Pipeline	Lock-bar/Steel	1927-1928	54	2	5	4	1.6	4.9	5	1	
Alameda Siphon 1	X30 to X35	10/1/2010	7/1/2033	0.56	Siphon	RCP	1933	69	1	1	3.8	2.8	0.5	5	1	
BDPL No. 2	A10 to A20	10/1/2010	10/1/2033	7.12	Pipeline	RCP and Steel	1935	66	1	5	3.8	2.5	4.1	5	1	
BDPL No. 1	B10 to B20	3/1/2011 and 8/1/2015 and 10/8/2019	10/1/2033	7.11	Pipeline	RCP and Steel	1933	60	2	5	3.8	2	4.1	5	1	
BDPL No. 4	D10 to D20		1/1/2034	8.52	Pipeline	PCCP	1967	96	5	5	2.7	5	4	5	1	
Crystal Springs Bypass Tunnel (inspect every 10 years)	G20 to G32 and G34	1/1/2011	4/1/2034	3.12	Tunnel	Steel	1970	114	1	4	2.6	5		1	5	
New Crystal Springs Bypass Tunnel	G32 to G36		4/1/2034	0.80	Tunnel	Steel	2012	96	1	2	1.1	5	1.5	1	1	
Alameda Siphon 4	All		1/1/2035	0.54	Siphon	Steel	2013	66	1	1	1.1	2.5	0.5	5	1	
SAPL No. 3	T60 to CDD		1/1/2035	1.94	Pipeline	Steel	2012	36	1	5	1.1	0.1	3.7	5	1	
BDPL No. 5	E60 to E70		4/1/2035	4.00	Pipeline	Steel	2013	60	1	5	1.1	2	3.9	5	1	
BDPL No. 5	E50U to Redwood City Valve Lot		7/1/2035	4.93	Pipeline	Steel	2013	60	1	5	1.1	2	4.1	5	1	
BDPL No. 5	NIT to Newark Valve Lot		10/1/2035	7.01	Pipeline	Steel	2013	72	1	5	1.1	3	4.1	5	1	
SABPL	All		1/1/2036	1.32	Pipeline	Steel	2013	66	1	1	1	2.5	0.4	5	1	
Sunset Branch	N42 to M41	10/1/2013	4/1/2036	1.11	Pipeline	Steel	1954	61	1	5	3.1	2.1	2.7	5	1	
CSPL No. 2	K10 to K20	5/21/2014	1/1/2037	2.36	Pipeline	Steel	1937	54-60	1	3	3.7	2	2.3	5	1	
Crystal Springs San Andreas Force Main	H83 to San Andreas		4/1/2037	4.50	Force Main	Steel	2015	60	1	2	1	2		5	1	
Irvington Tunnel 1	All	4/4/2015	10/1/2037	3.48	Tunnel	Steel	1933	126	1	2	3.8	5		1	1	
BDPL No. 2	B50U to B60	7/1/2015	1/1/2038	4.92	Pipeline	Steel	1935	66	1	5	3.8	2.5	4.1	5	1	
SVWTP 78" Effluent Pipeline	All	9/1/2015	4/1/2038	1.59	Pipeline	Steel	1966	78	1	1	2.7	3.5	0.7	5	1	
Calaveras Pipeline	SVWTP to W10	9/1/2015	4/1/2038	1.63	Pipeline	Steel	1966	66	2	1	2.7	2.5		5	1	
BDPL No. 4	D50 to D68		7/1/2038	7.86	Pipeline	PCCP	1967	84-96	5	5	2.7	5	3	5	1	

									INSPECTION PRIORITY SCORE							
									0.375	0.15	0.15	0.15	0.05	0.05	0.075	1.00
Pipeline	Section	Date Last Inspection	Date Next Inspection	Miles	Type	Matl.	Year Built	Dia.	Matl.	Pop. Density	Age	Dia.	Pipeline PSI	Pipeline=5 Adit=4 Tunnel=1	Redun-dancy	SCORE TOTAL
San Antonio Pipeline	W20 to Y20		7/1/2038	2.07	Pipeline	PCCP	1967	60	5	1	2.7	2	0.9	5	1	
Alameda Siphon 3	X20 to X22 and X25		7/1/2038	0.55	Siphon	PCCP	1967	96	5	1	2.7	5	0.5	5	1	
Balancing Reservoir Pipeline	All		7/1/2038	0.21	Pipeline	PCCP	1975	96	5	1	2.4	5	0.1	5	1	
Pilarcitos Tunnel 1 and 200 feet of 33-inch Concrete Pipeline	S10 to S13	7/7/2016	10/1/2039	0.29	Tunnel	Brick	1868	3'6" x 5'1"	2	1	5	5		1	1	
CSPL No. 2	K40 to K50	10/12/2016	1/1/2040	3.86	Pipeline	Steel	1937	54-60	1	5	3.7	2	2.9	5	1	
Bay Tunnel	E20U to E50U, B50U and A50U	11/16/2016	4/1/2040	5.14	Tunnel	Steel	2015	108	1	1	1	5		1	5	
Calaveras Outlet Pipe	Outlet Tower to V34	5/9/2017	7/1/2040	0.28	Adit	Steel	2016	72-78	1	1	1	3		4	1	
Upper Alameda Creek Tunnel	Upper Alameda Creek to Calaveras Reservoir	1/16/2018	7/1/2040	1.85	Tunnel	Concrete	1931	5'6" x 6'6"'	1	1	3.9	5		1	1	
CSPL No. 3	L30 to L41K	11/16/2017	10/1/2040	3.61	Pipeline	PCCP	1971	60	5	5	2.5	2	2.9	5	1	
CSPL No. 3	P48 to L59K	11/16/2017	10/1/2040	2.54	Pipeline	PCCP	1987	60	5	5	2	2	2.9	5	1	
Crystal Springs Bypass Pipeline	G34 to G41		1/1/2041	0.81	Pipeline	PCCP	1970	96	5	2	2.6	5	1.5	5	1	
BDPL Nos. 3 and 4 Crossover Pipelines	I-680	5/30/2018	1/1/2041	0.41	Pipeline	Steel	2014	78	1	5	1.1	3.5	2.5	5	1	

Notes:

BDPL = Bay Division Pipeline
CDD = City Distribution Division
CSPL = Crystal Springs Pipeline
NIT = New Irvington Tunnel
PCCP = prestressed concrete cylinder pipe
RCP = reinforced concrete cylinder pipe
SABPL = San Antonio Backup Pipeline
SAPL = San Andreas Pipeline
SSPL = Sunset Supply Pipeline
SVWTP = Sunol Valley Water Treatment Plant

Appendix D: Watershed Map



Appendix E: Proposed Level of Service

San Francisco Amended and Updated Water System Level of Service Goals and Objectives
June 2, 2021

In 2008, the SFPUC adopted Level of Service Goals and Objectives (Levels of Service or LOS) for the Water Enterprise in conjunction with the approval of the Water System Improvement Program Programmatic Environmental Impact Report. Those Levels of Service provided the basis for many of the WSIP project designs. These draft Amended and Updated LOS Goals and Objectives build from the base of those adopted in 2008. They retain the 2008 Levels of Service and carry them forward with additions to be sure that Levels of Service are maintained, to clarify them, and to cover areas that were not included in 2008, such as In-City Delivery Reliability. Also, a number of Levels of Service Objectives have been added that relate to our workforce and our role in the communities we serve, consistent with the SFPUC's 2020 Strategic Plan.

Drinking Water Quality – ***maintain high water quality***

- Comply with or surpass all current and foreseeable future federal and state drinking water quality requirements.
- Provide clean, unfiltered water originating from Hetch Hetchy Reservoir, filtered water from local watersheds, and appropriately treated water from other sources.
- Continue to implement watershed protection measures in the SFPUC's Peninsula, East Bay and Tuolumne watersheds to protect watershed ecosystems and drinking water quality.
- Respond to 100% of In-City customer service inquiries or complaints regarding water quality within 2 business hours of initial contact and regional water system events upon exceedance of established threshold criteria.

Regional Seismic Reliability – ***maintain ability to meet current seismic standards***

- Design water system improvements to meet current seismic standards, and regularly evaluate the ability of the system to meet current seismic standards.
- Maintain/resume delivery of 229 mgd to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively.
- Restore facilities to meet an average annual demand of 265 mgd within 30 days after a major earthquake.

Regional Delivery Reliability – ***maintain post-WSIP delivery reliability and ability to maintain the system***

- Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service.
- Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages.
- Maintain emergency response and recovery plans for major delivery assets to minimize the duration of unplanned outages.
- Provide operational flexibility and system capacity to replenish local reservoirs as needed.
- Meet an average annual demand of 265 mgd under the conditions of one planned shutdown of a major facility for maintenance (a reach of a San Joaquin Pipeline or a reach of a Bay Division Pipeline) concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset. (Note: Planned shutdowns of the Hetch Hetchy system are restricted to the period of November 1 through March 31, and no longer than 60 days with special exceptions for shutdowns of up to 100 days.)
- Maintain a defined security posture that meets or exceeds those standards set forth in the National Infrastructure Protection Plan.
- Provide Wholesale Customers with timely information and data sufficient to support operational decision-making of their retail systems.

In-City Seismic Reliability – ***reduce vulnerability to earthquakes***

- **Storage**. Maintain seismically reliable potable water storage to provide at least 20 psi pressure throughout each pressure zone.

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- **Fire Suppression.** In conjunction with the Emergency Firefighting Water System (EFWS), within one hour of a major earthquake, provide at least 50% of anticipated water demand from post-seismic fires in each of 46 Fire Response Areas, and at least 90% of City-wide average water demand from post-seismic fires[1].
- **Water Supply Restoration.** Deliver basic life sustaining supply (hygiene, sanitation, and consumption if boiled or disinfected) and potable water system restoration.
    - Within 24 hours, limited network of critical transmission mains (greater than or equal to 12-inch diameter) that serve major hospitals[2] will be pressurized.
    - Within 72 hours, limited network of critical secondary distribution system pipelines (< 12-inch diameter) will be pressurized.
    - Within 7 days, limited network of critical transmission and distribution mains will be disinfected and restored to potable service.
    - Within 90 days, secondary distribution system will be restored to potable service.

In-City Delivery Reliability – ***reliably deliver water to all in-City retail customers***

- Maintain potable water storage to provide at least two days of winter day demand plus minimum 2 hours of fire suppression at 3 hydrants (4,500 gpm) in each pressure zone with storage greater than one million gallons, and two hydrants (3,000 gpm) for each pressure zone with storage ≤ one million gallons.
- Maintain minimum pressure of 20 psi throughout distribution system.
- Respond to 100% of customer service inquiries or complaints regarding water service within 2 business hours of initial contact.
- Maintain deliveries such that ≤ 1.0% of service connections are without water for up to 4 hours as a result of an unplanned outage per year.
- Maintain deliveries such that ≤ 0.5% of service connections are without water for 8 hours or longer as a result of an unplanned outage per year.
- Maintain a defined security posture for all facilities that meets or exceeds those standards set forth in the National Infrastructure Protection Plan.

Water Supply – ***meet customer water needs in non-drought and drought periods***

- Meet all state and federal regulations to support the proper operation of the water system and related power facilities.
- Meet an average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during non–drought years for system demands consistent with the 2009 Water Supply Agreement.
- Meet dry-year delivery needs while limiting rationing to a maximum 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.
- Maintain San Francisco retail residential potable water use below 50 gallons per capita per day.
- Realize annual Real Water Losses[3] of less than 10% of water supplied to San Francisco.
- Meet 80% of San Francisco's Recreation and Parks Department irrigation demands with recycled water by December 31, 2022.

Environmental Stewardship - ***maintain high environmental performance standards***

- Meet all current and anticipated environmental legal requirements.
- Manage watershed and Right of Way lands to protect and restore native ecological resources and to minimize wildfire risk.
- Provide the public with appropriate educational opportunities by maintaining active education programs and recreational opportunities (where appropriate) in cooperation with other federal, state and local agencies.

[1] More detailed levels of service to be developed through EFWS analysis.
[2] Current goal is major trauma centers (UCSF and SF General) but may be expanded to additional critical care facilities in coordination with DEM and other City agency planning.
[3] Water that escapes the water distribution system, including leakage and storage overflows.

Page 2 of 3

San Francisco Amended and Updated Water System Level of Service Goals and Objectives
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- Manage and operate the Water Enterprise assets consistent with the Water Enterprise Environmental Stewardship Policy.

Sustainability – ***enhance sustainability in all system activities (environmental, economic and social)***

- **Energy Utilization**
  - Maintain a gravity-driven water system.
  - Minimize carbon footprint of all water system operations through sustainable design and operational practices.
- **Workforce Support**
  - Attract, develop, and retain a healthy, safe, well-trained, productive, and well-equipped workforce, reflective of the communities we serve.
  - Provide and promote opportunities for knowledge transfer and staff development in areas critical to meeting LOS goals and objectives.
  - Implement the Water Enterprise Racial Equity Action Plan.
- **Community Support**
  - Be mindful of and responsive to community needs throughout the water system, consistent with operating and maintaining the water system.
  - Maintain active program of public outreach regarding all aspects of the water system.
- **Cost-effectiveness**
  - Ensure cost-effective use of funds and other resources.
  - Provide water meter data for fair and timely billing of both wholesale and retail water customers, as well as effective management of water supplies.
  - Implement effective management programs for all assets (facilities, lands and equipment), including:
    - Regular updates of asset registry.
    - Regular preventive maintenance and inspection.
    - Appropriate repair and replacement.
- **Strategic Planning**
  - Continually evaluate and plan for changing environmental, fiscal and social conditions, (e.g. climate change, development, regulation and other factors outside of the SFPUC's control) that influence the ability to achieve these Levels of Service.