2 Existing Regional Water System

CHAPTER 2
Existing Regional Water System

2.1 System Overview

The City and County of San Francisco (CCSF), through the San Francisco Public Utilities Commission (SFPUC), owns and operates a regional water system that serves 2.4 million people, primarily in San Francisco and the south San Francisco Bay region. The system extends about 167 miles, from Yosemite National Park to San Francisco, and develops water supply from three principal watersheds: the Tuolumne River, Alameda, and Peninsula watersheds. This water is conveyed to retail and wholesale customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The system currently delivers an annual average of about 265 million gallons per day (mgd), of which about 85 percent is from the Tuolumne River watershed and about 15 percent is from the combined Alameda and Peninsula watersheds (referred to collectively as the "local" watersheds). The regional water system includes over 280 miles of pipeline, over 60 miles of tunnels, 11 reservoirs, 5 pump stations, and 2 water treatment plants (filtration). The history of the system dates back to the 1860s, and many parts of it are over 100 years old.

This chapter provides a summary description and background of the existing regional water system, with emphasis on those components of the system that would be modified or otherwise affected by the proposed Water System Improvement Program (WSIP or program). This chapter also describes the sources and quantity of water used and how the water is generally conveyed, stored, treated, and delivered to system customers. Laws, regulations, and other institutional factors relevant to the water system are also described. Information on the system related to the proposed program, including more detail on the system customers and service area, is presented in Chapter 3, Program Description.

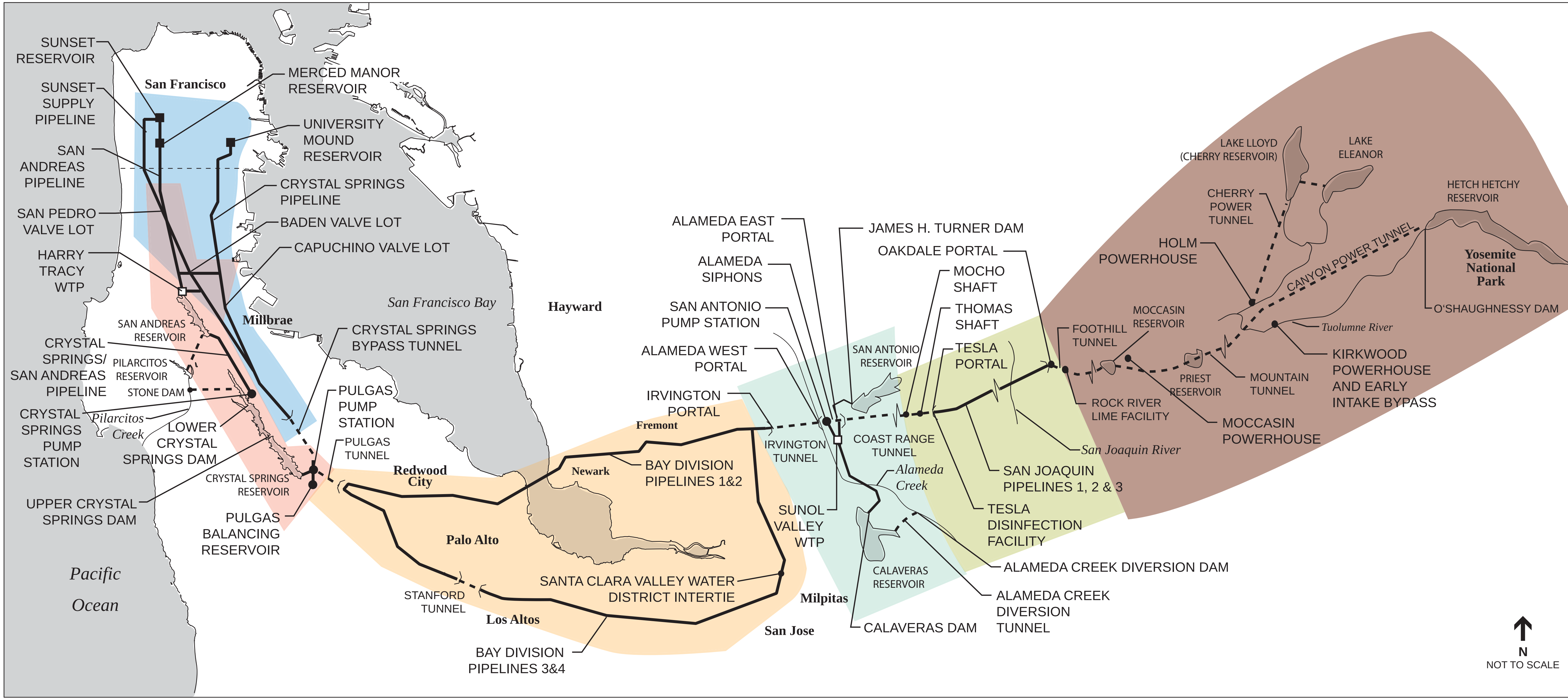
2.2 Regional Water System Facilities

The regional water system is primarily a linear system; it transports water across the state, from the Sierra Nevada to the Bay Area, almost entirely by gravity. Major facilities in the regional water system are shown in **Figure 2.1**. For the organizational purposes of this Program Environmental Impact Report (PEIR), the regional water system can be divided geographically into six smaller regions, which are, from east to west, the Hetch Hetchy, San Joaquin, Sunol Valley, Bay Division, Peninsula, and San Francisco Regions. The Hetch Hetchy Region covers the east end of the system in Tuolumne County and continues west to the east side of the San Joaquin Valley, almost to the western boundary of Tuolumne County; the San Joaquin Region covers facilities in the San Joaquin Valley, from the western boundary of Tuolumne County through Stanislaus and San Joaquin Counties, almost to the east boundary of Alameda County; the Sunol Valley Region includes facilities in the Sunol Valley within Alameda and Santa Clara Counties and west to the city of Fremont; the Bay Division Region starts in Fremont and covers the general South Bay area, including parts of Alameda, Santa Clara, and San Mateo Counties, continuing west to the south end of the San Francisco Peninsula; the Peninsula Region is entirely on the Peninsula within San Mateo County, from about San Mateo to Daly City; and the San Francisco Region, which geographically overlaps with the Peninsula Region, covers facilities in northern San Mateo County and within San Francisco. **Table 2.1** lists major facilities in the regional water system by their primary function—storage, transmission, or treatment—as well as by their geographic region. **Table 2.2** shows the capacity of the major facilities in the regional water system.

2.2.1 Hetch Hetchy Facilities

The regional water system begins with Hetch Hetchy Reservoir and O'Shaughnessy Dam, which are located in Yosemite National Park on the main stem of the Tuolumne River in the Sierra Nevada. Hetch Hetchy Reservoir was constructed between 1912 and 1923 and was raised in height in 1938. It collects drainage primarily in the form of snowmelt from the surrounding 459 square miles of the Tuolumne River watershed, which is located entirely within Yosemite National Park. The water from Hetch Hetchy Reservoir is used to supply system customers as well as to generate hydroelectric power; the reservoir is also operated to provide instream flows to benefit fisheries and other wildlife.

Two additional reservoirs in the Hetch Hetchy Region—Lake Eleanor and Lake Lloyd (also called Cherry Reservoir)—collect water from the Tuolumne River basin. Lake Eleanor (completed in 1918) is located within Yosemite National Park, and Lake Lloyd (completed in 1955) is located west of Yosemite National Park in Stanislaus National Forest; both reservoirs are



San Francisco Region
Peninsula Region
Bay Division Region
Sunol Valley Region
San Joaquin Region
Hetch Hetchy Region

Pipeline
Tunnel
Water Treatment Plant (WTP)
Other Facilities
Segments of the system not shown

SOURCE: SFPUC

SFPUC Water System Improvement Program . 203287

Figure 2.1
SFPUC Regional Water System

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TABLE 2.1
MAJOR FACILITIES IN THE REGIONAL WATER SYSTEM

Type of Facility	Hetch Hetchy Facilities (from the Sierra Nevada to the east side of the San Joaquin Valley)	San Joaquin Facilities (from the San Joaquin Valley to the west side of the Coast Ranges)	Sunol Valley Facilities (from the Sunol Valley to the west side of the East Bay Hills)	Bay Division Facilities (from Fremont to Redwood City)	Peninsula Facilities (from Redwood City to San Francisco)	San Francisco Regional Facilities (San Francisco and the northern Peninsula)
Storage Reservoirs	Hetch Hetchy Reservoir and O'Shaughnessy Dam Lake Eleanor and Eleanor Dam Lake Lloyd (also called Cherry Reservoir) and Cherry Dam (also called Cherry Valley Dam)	None	Calaveras Reservoir and Calaveras Dam San Antonio Reservoir and James H. Turner Dam	None	Crystal Springs Reservoir and Upper and Lower Crystal Springs Dams San Andreas Reservoir and San Andreas Dam Pilarcitos Reservoir and Pilarcitos Dam Stone Dam Reservoir and Stone Dam	University Mound Reservoir Sunset Reservoir Merced Manor Reservoir
Transmission	Canyon Power Tunnel Eleanor-Cherry Diversion Tunnel and Pump Station Cherry Power Tunnel Lower Cherry Diversion Dam and Aqueduct Mountain Tunnel Foothill Tunnel Priest Reservoir Moccasin Penstocks Moccasin Reservoir	San Joaquin Pipelines Nos. 1, 2, 3 Coast Range Tunnel	Alameda Siphons Nos. 1, 2, 3 Alameda Creek Diversion Dam and Tunnel Calaveras Pipeline Sunol Valley Water Treatment Plant Effluent Pipeline San Antonio Pipeline San Antonio Pump Station Irvington Tunnel	Bay Division Pipelines Nos. 1, 2, 3, 4 Santa Clara Valley Water District Intertie East Bay Municipal Utility District Intertie	Pulgas Tunnel Pulgas Pump Station Pulgas Balancing Reservoir Crystal Springs Bypass Tunnel Crystal Springs/ San Andreas Pipeline Crystal Springs Pump Station Baden Pump Station Pilarcitos Tunnels and Stone Dam Tunnels	San Andreas Pipelines Crystal Springs Pipeline Sunset Supply Pipeline
Treatment	Rock River Lime Facility	Tesla Disinfection Facility Thomas Shaft Disinfection Facility	Sunol Valley Chloramination Facility Sunol Valley Water Treatment Plant	None	Pulgas Dechloramination Facility Harry Tracy Water Treatment Plant	None

SOURCE: SFPUC, 2005a.

TABLE 2.2
EXISTING CAPACITY OF MAJOR FACILITIES IN THE REGIONAL WATER SYSTEM

Facility	Capacity	Notes
Major Storage Facilities		
Hetch Hetchy Reservoir	360,400 acre-feet (with drum gates raised) 340,000 acre-feet (with drum gates lowered)	117.4 billion gallons 110.8 billion gallons
Lake Eleanor	27,100 acre-feet (with flashboards installed) 21,500 acre-feet (without flashboards)	8.8 billion gallons 7.0 billion gallons
Lake Lloyd (Cherry Reservoir)	273,300 acre-feet (with flashboards installed) 268,800 acre-feet (without flashboards)	89.1 billion gallons 87.6 billion gallons
Calaveras Reservoir[a]	96,800 acre-feet (normal conditions) 37,800 acre-feet (interim conditions as required by the Division of Safety of Dams)	31.5 billion gallons 12.4 billion gallons
San Antonio Reservoir	50,300 acre-feet	16.4 billion gallons
Crystal Springs Reservoir[b]	56,800 acre-feet (interim conditions as required by the Division of Safety of Dams) 68,000 acre-feet (normal conditions)	18.5 billion gallons 22.2 billion gallons
Pilarcitos Reservoir	2,900 acre-feet	0.97 billion gallons
San Andreas Reservoir	19,000 acre-feet	6.2 billion gallons
Sunset Reservoir (north and south)	540 acre-feet	174.8 million gallon
University Mound Reservoir (north and south)	430 acre-feet	140.9 million gallons
Merced Manor Reservoir	30 acre-feet	9.5 million gallons
Major Transmission Facilities		
Canyon Tunnel	873 mgd	1,350 cfs
Mountain Tunnel	433 mgd	670 cfs
Foothill Tunnel	450 mgd	700 cfs
San Joaquin Pipelines Nos. 1, 2, 3	290–300 mgd (total, 3 pipelines)	Physical design capacity approximately 300 mgd
Coast Range Tunnel	345 mgd	541 cfs
Irvington Tunnel	300–340 mgd	300 mgd in winter, 340 mgd in summer
Bay Division Pipelines Nos. 1, 2, 3, 4	290–340 mgd (total, 4 pipelines)	
Major Treatment Facilities		
Sunol Valley Water Treatment Plant	120 mgd (sustainable capacity) 160 mgd (peak capacity)	Sustainable capacity is the highest flow rate at which a treatment plant can be expected to operate, given normal source water conditions, while meeting regulatory water quality and routine maintenance requirements. Peak capacity is the maximum flow rate to which a treatment plant is designed that will allow it to operate within regulatory or engineering standards.
Harry Tracy Water Treatment Plant	120 mgd (sustainable capacity) 140 mgd (peak capacity) 180 mgd (hydraulic capacity)	Plant capacity depends on the quality of raw water. During most winters, the raw water source often contains algae that can limit plant capacity to 90–100 mgd for several weeks.

[a] As designed and constructed, Calaveras Reservoir has a normal capacity of 96,800 acre-feet. However, the California Division of Safety of Dams (DSOD) has placed interim operational restrictions on the reservoir due to concerns regarding seismic stability of the dam. See Section 2.2.3 for further discussion.

[b] Since 1983, the DSOD has placed operational restrictions on Lower Crystal Springs Dam due to concerns regarding the stability of the dam during major flood events. Over the past 23 years, the SFPUC has adjusted its operating procedures to comply with the DSOD restrictions and, with the exception of the 1987 to 1992 drought period, has been able to accommodate customer water demands with this reduced level of storage in Crystal Springs Reservoir. However, it should be noted that the DSOD restriction on Crystal Springs Reservoir operations has reduced storage capacity in the Peninsula watershed by 17 percent, a critical concern from the perspective of emergency preparedness.

SOURCES: SFPUC, 2004; Olivia Chen Consultants, 2005; CDM, 2005; URS, 2006.

northwest of Hetch Hetchy Reservoir on tributaries to the Tuolumne River. The Eleanor-Cherry Diversion Tunnel and Pump Station link the two reservoirs, allowing them to be operated as a single unit.

Under normal operating conditions, Hetch Hetchy Reservoir is the only reservoir in this region that directly supplies water to the Bay Area; as discussed in Section 2.4, Hetch Hetchy water is delivered to customers without filtration, since the quality of this water supply has warranted a filtration exemption[1] from the U.S. Environmental Protection Agency (U.S. EPA) and California Department of Health Services (DHS). Water from Lake Eleanor and Lake Lloyd is used primarily to meet minimum instream flow requirements to benefit fish and other wildlife, satisfy downstream water rights of the Turlock and Modesto Irrigation Districts (TID and MID) (discussed in Section 2.5, below), produce hydroelectric power, and provide flows to support recreational use including whitewater recreation. However, if necessary during emergency or drought conditions, water from Lake Lloyd or Lake Eleanor can be released to Cherry Creek and then diverted to Mountain Tunnel for transport to the Bay Area, which occurred once during the early 1990s. In the event that water from Cherry and Eleanor Creeks is diverted to the regional water system, filtration of all water delivered from the Hetch Hetchy system would be necessary prior to delivery to customers, in accordance with requirements of the U.S. EPA and DHS.

From Hetch Hetchy Reservoir, water diverted at O'Shaughnessy Dam flows by gravity through the 10-mile-long Canyon Power Tunnel to Kirkwood Powerhouse to generate power. From Kirkwood Powerhouse, depending on flows from Canyon Tunnel, water is either returned to the river or diverted into the Early Intake Bypass and then to Mountain Tunnel. When Hetch Hetchy Reservoir was originally constructed, water from the face of the dam flowed down the river to Early Intake Reservoir (built in 1924), and from there was diverted to Mountain Tunnel; with the construction of Canyon Power Tunnel and the Early Intake Bypass in the 1960s, the Early Intake Reservoir and Diversion Dam lost much of their functional role in the regional system, and Tuolumne River water flows relatively unimpeded through the spillway adjacent to the diversion dam. Early Intake Reservoir and Diversion Dam, however, continue to serve important functions because they permit the SFPUC to divert water into the Mountain Tunnel from Cherry or Eleanor Creeks in emergencies or extended drought, and from the Tuolumne River in the event of loss of Canyon Tunnel or the Kirkwood Penstocks.

The 19-mile-long Mountain Tunnel, completed in 1925, allows the SFPUC to deliver raw water to the Groveland Community Services District, a retail customer. From Mountain Tunnel, the water is conveyed by gravity through Priest Reservoir, Moccasin Powerhouse, and Moccasin Reservoir. These two reservoirs regulate flows between facilities and can facilitate power peaking operations. If turbidity becomes a concern in these reservoirs, water is bypassed through pipelines. After Moccasin Reservoir, water travels through the Moccasin Gate Tower to the 16-mile-long Foothill Tunnel (completed in 1928), which passes beneath Don Pedro Reservoir

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1 As described in Section 2.4, the U.S. Environmental Protection Agency and the California Department of Health Services have determined that Hetch Hetchy water supply meets all state and federal water quality requirements without the need to provide filtration. In addition, the Hetch Hetchy water supply is disinfected in accordance with Safe Drinking Water Act requirements.

(owned by TID and MID) and ends at Oakdale Portal (where the San Joaquin Pipelines begin). Approximately three miles upstream from Oakdale Portal is the Rock River Lime Facility, where chemicals are added to water in Foothill Tunnel for corrosion control (SFPUC, 2004). The station is located above a shaft that accesses Foothill Tunnel. Water deliveries from the Hetch Hetchy system are transported entirely by gravity to the San Joaquin Region.

2.2.2 San Joaquin Facilities

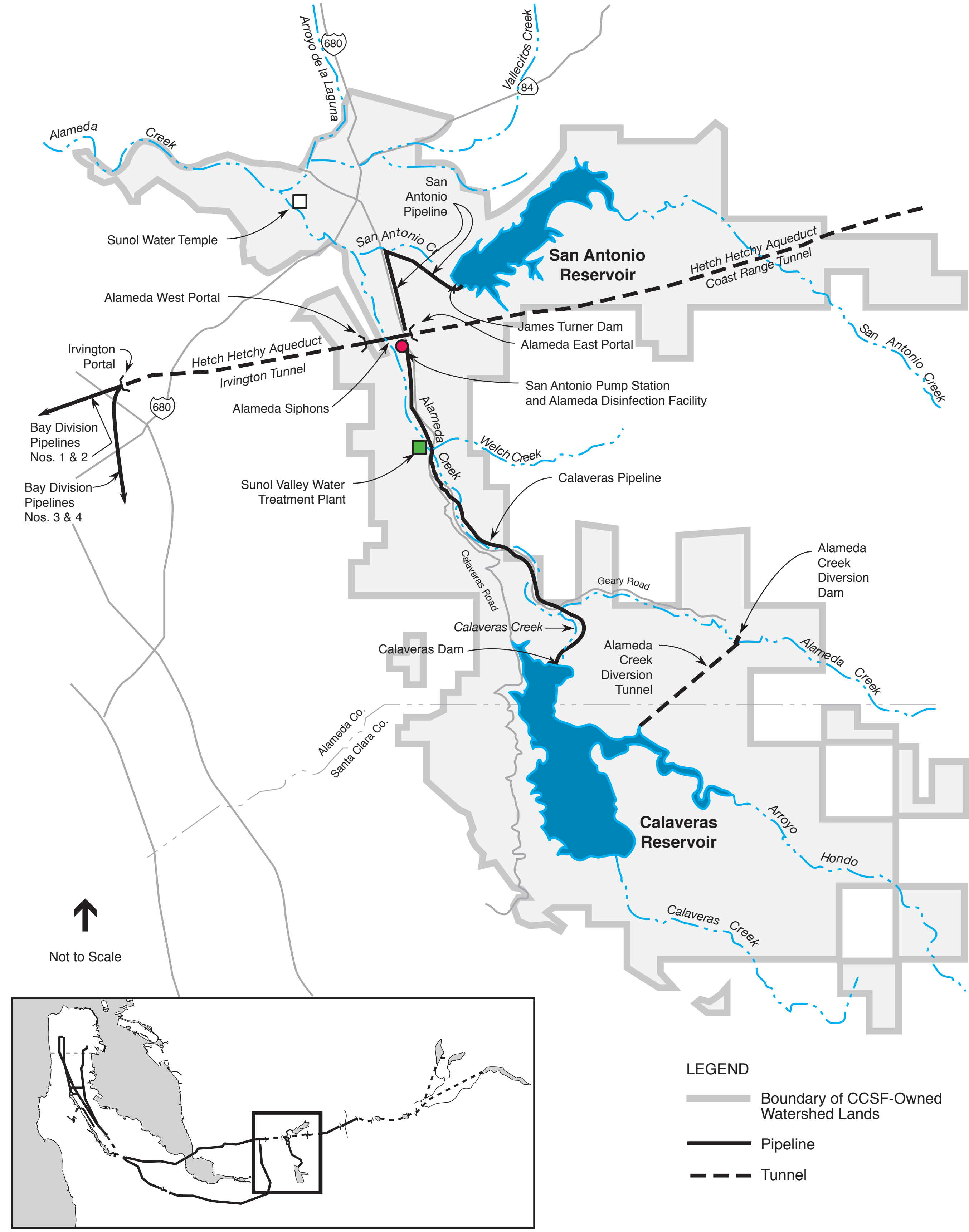
Oakdale Portal is the connection between the western end of Foothill Tunnel and the San Joaquin Pipelines. From Oakdale Portal, water from the Hetch Hetchy facilities is conveyed 47 miles west across the San Joaquin Valley by gravity in three parallel pipelines known as San Joaquin Pipelines Nos. 1, 2, and 3 (built in 1932, 1953, and 1968, respectively). The three pipelines are buried for most of their full length. The pipelines pass through Modesto, under the San Joaquin River, and past Tracy to Tesla Portal on the west side of the San Joaquin Valley. The current capacity of the three pipelines is approximately 290 mgd; however, when originally planned in 1912, the San Joaquin Pipeline system was envisioned with an ultimate nominal capacity of 400 mgd.

The San Joaquin Pipelines end at Tesla Portal and connect to the Coast Range Tunnel (built from 1927 to 1934). Tesla Portal, which is located on the east side of the Coast Ranges, is also the location of the Tesla Disinfection Facility, where Hetch Hetchy water is disinfected with chlorine and monitored for water quality. From Tesla Portal, the chlorinated Hetch Hetchy water is transported 25 miles through the Coast Range Tunnel to system facilities in the Sunol Valley. Water delivery to Lawrence Livermore Laboratory, a retail customer, occurs from the Coast Range Tunnel via two access shafts from the tunnel, Thomas and Mocho Shafts. At Thomas Shaft, a standby/backup chlorination facility provides disinfection in the event of operational difficulty at Tesla Portal. The 25-mile-long Coast Range Tunnel ends at the Alameda East Portal in the Sunol Valley (SFPUC, 2004). Again, water deliveries are transported entirely by gravity across the San Joaquin Region to the Sunol Valley.

2.2.3 Sunol Valley Facilities

Local water supplies from the Alameda watershed enter the regional system in the Sunol Valley and are blended with the Hetch Hetchy water supply. The Alameda watershed generally refers to CCSF-owned lands that are located within the much larger hydrologic boundaries of the southern Alameda Creek watershed. Local water supply sources contributing to the regional water system include Arroyo Hondo and Alameda and Calaveras Creeks, which provide inflow to Calaveras Reservoir, and San Antonio Creek, which flows to San Antonio Reservoir. **Figure 2.2** shows a schematic of the SFPUC's Alameda watershed facilities.

The Alameda East Portal is the connection between the Coast Range Tunnel and the Alameda Siphons. The Alameda Siphons are three pipelines (built in 1934, 1953, and 1967) that cross the Sunol Valley and beneath Alameda Creek. The roughly 3,000-foot-long Alameda Siphons connect the Coast Range Tunnel at the Alameda East Portal to the Irvington Tunnel at the Alameda West Portal. At the Alameda Siphons, Hetch Hetchy water is blended with water from Calaveras



SOURCE: San Francisco Planning Department, 2000

SFPUC Water System Improvement Program . 203287

Figure 2.2
Alameda Watershed Facilities

and San Antonio Reservoirs that has been treated at the Sunol Valley Water Treatment Plant (WTP). Directly adjacent to the Alameda Siphons, the Sunol Valley Chloramination Facility provides secondary disinfection with chloramine, along with fluoride addition and pH adjustment for corrosion control, for both Hetch Hetchy water and treated water from the Sunol Valley WTP prior to transmission to the Bay Area. Water deliveries to the General Electric pumping facility and individual accounts in the town of Sunol, both retail customers, occur from two of the siphons at a location downstream of the blending point for treated water with Hetch Hetchy water.

Calaveras Reservoir, located at the south end of the Alameda watershed, collects and stores water from the local watershed, including drainage from Calaveras Creek and Arroyo Hondo. The reservoir was originally constructed in 1913 and was completed in 1925. The Alameda Creek Diversion Dam and Tunnel, constructed from 1925 to 1931 following completion of Calaveras Dam, divert flows and drainage from the southern Alameda Creek watershed into Calaveras Reservoir. Water from Calaveras Reservoir flows by gravity through the Calaveras Pipeline to the Sunol Valley WTP for treatment, and then flows to the Alameda Siphons, where it is blended with the Hetch Hetchy water supply. Water from Calaveras Reservoir can also be transferred for storage to San Antonio Reservoir and later for treatment at the Sunol Valley WTP.

In 2001, the California Department of Water Resources, Division of Safety of Dams (DSOD) performed an evaluation of Calaveras Dam and concluded that the dam does not meet current seismic stability criteria at normal operating levels due to properties of the soil material used in dam construction (DSOD, 2003; Olivia Chen Consultants, 2003). As a result, the DSOD placed interim operational restrictions on Calaveras Reservoir, lowering the level at which the reservoir can be safely operated and restricting the maximum water elevation to 705 feet. These restrictions reduced the total storage capacity of the reservoir by 60 percent (see Table 2.2 for normal and restricted reservoir capacities) and the total working storage capacity of the SFPUC's local reservoirs by over 30 percent. Due to the DSOD restrictions, the Calaveras system is currently diverting less flow from Alameda Creek via the Alameda Creek Diversion Dam and utilizes less water from Calaveras Reservoir. In addition, in 1991 the SFPUC and California Department of Fish and Game (CDFG) agreed on a minimum operating level for Calaveras Dam of 690 feet to protect juvenile fish populations (described below in Section 2.5.3). Therefore, under DSOD and CDFG restrictions, the SFPUC currently operates Calaveras Reservoir at water level elevations ranging between 690 and 705 feet to the extent feasible.[2]

These interim operating procedures allow the SFPUC to continue meeting water needs from local sources to a limited extent; however, the DSOD restrictions were placed "with the understanding that the SFPUC will continue to pursue an aggressive schedule for the remediation of Calaveras Dam" (DSOD, 2003). The SFPUC has adjusted its system operations to meet these restrictions, but considers this an impaired operating mode that puts the system at risk of being unable to adequately meet customer water demands in the event of an emergency or a prolonged drought. From the perspective of emergency preparedness, the DSOD restriction has reduced the SFPUC's total

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2 Since December 2001 following periods of heavy inflow, reservoir storage levels have risen temporarily beyond the restricted levels. At such times, the SFPUC employs best efforts to lower the reservoir level by releasing water to the regional system, and if necessary, discharging excess inflow to Calaveras Creek below Calaveras Dam.

reservoir storage, including its emergency storage capacity, by over 58,000 acre-feet. The SFPUC is complying with the DSOD requirements by actively pursuing remediation of Calaveras Dam. The Calaveras Dam Replacement project is in development as part of the WSIP, and the San Francisco Planning Department initiated environmental review of this project in October 2005.

San Antonio Reservoir and Turner Dam, completed in 1965, impound water from San Antonio Creek. This reservoir can also receive and store water from the Hetch Hetchy water supply or from Calaveras Reservoir. Water stored in San Antonio Reservoir must be conveyed in the San Antonio Pipeline to the Sunol Valley WTP for treatment before it can be added to the regional distribution system at the Alameda Siphons.

The Sunol Valley WTP was constructed in 1966 and upgraded in 2003 to a peak capacity of 160 mgd (with a sustained capacity of 120 mgd); it can treat water from the local Alameda watershed drainages, including waters stored in both the Calaveras and San Antonio Reservoirs. Water from the Hetch Hetchy system can also be treated at the Sunol Valley WTP, which is necessary when the water does not meet DHS permit conditions as it enters the Sunol Valley (which occurs on rare occasions due to storm events in the Sierra causing high turbidity levels, or to conditions in the San Joaquin Pipelines) and when Hetch Hetchy water is used to maintain water treatment operations at the plant.

Hetch Hetchy water from the Coast Range Tunnel that is blended with treated water from the Alameda watershed in the Alameda Siphons then exits the Sunol Valley at the Alameda West Portal, located at the west end of the Alameda Siphons, where it enters the 3.5-mile-long Irvington Tunnel and flows by gravity to the city of Fremont in the East Bay. Irvington Tunnel was constructed in the 1930s and has a maximum capacity of 340 mgd (CDM, 2005). It is the only operating facility that conveys Hetch Hetchy and treated Alameda watershed water supplies to the Bay Area; since it must operate year-round to meet Bay Area customer demands, maintenance and inspection of Irvington Tunnel has not occurred for over 40 years (SFPUC, 2004).

2.2.4 Bay Division Facilities

The Irvington Portal in Fremont, at the west end of Irvington Tunnel, is where the tunnel connects to the four Bay Division Pipelines (Nos. 1, 2, 3, and 4), which consist of two sets of two parallel pipelines constructed in 1925, 1936, 1952, and 1973, respectively. The Bay Division Pipelines serve multiple purposes: providing water to customers in the East Bay, South Bay, and Peninsula through turnouts along the pipelines; conveying water to users in the northern Peninsula and in San Francisco; and transmitting water to Crystal Springs Reservoir to supplement local storage in the Bay Area. Numerous valve lots along the pipelines allow for flow control.

The Bay Division Pipelines Nos. 1 and 2 are 22 miles long and pass through the cities of Fremont and Newark, cross San Francisco Bay at the Dumbarton Strait, and continue through East Palo Alto, Redwood City, Menlo Park, and Atherton; they include about 3,000 feet of submarine pipeline that passes under the bay, as well as aboveground pipeline supported on a pipe bridge over water or on a trestle over the land and marsh along the bay margin. Within the urban areas, the Bay Division Pipelines Nos. 1 and 2 are buried pipelines. These two pipelines feed the SFPUC's Palo Alto Pipeline.

The Bay Division Pipelines Nos. 3 and 4 extend 34 miles around the south end of San Francisco Bay, almost entirely as buried underground pipeline. These two pipelines pass through the cities of Fremont, Milpitas, San Jose, Santa Clara, Sunnyvale, Mountain View, Los Altos, Palo Alto, Menlo Park, Atherton, Woodside, and Redwood City. Pipelines Nos. 3 and 4 converge for approximately 1,360 feet of tunnel at the Stanford Tunnel in Palo Alto. Pipelines Nos. 3 and 4 reconnect with Pipelines Nos. 1 and 2 at the Pulgas Portal entrance to Pulgas Tunnel just west of Redwood City (SFPUC, 2004).

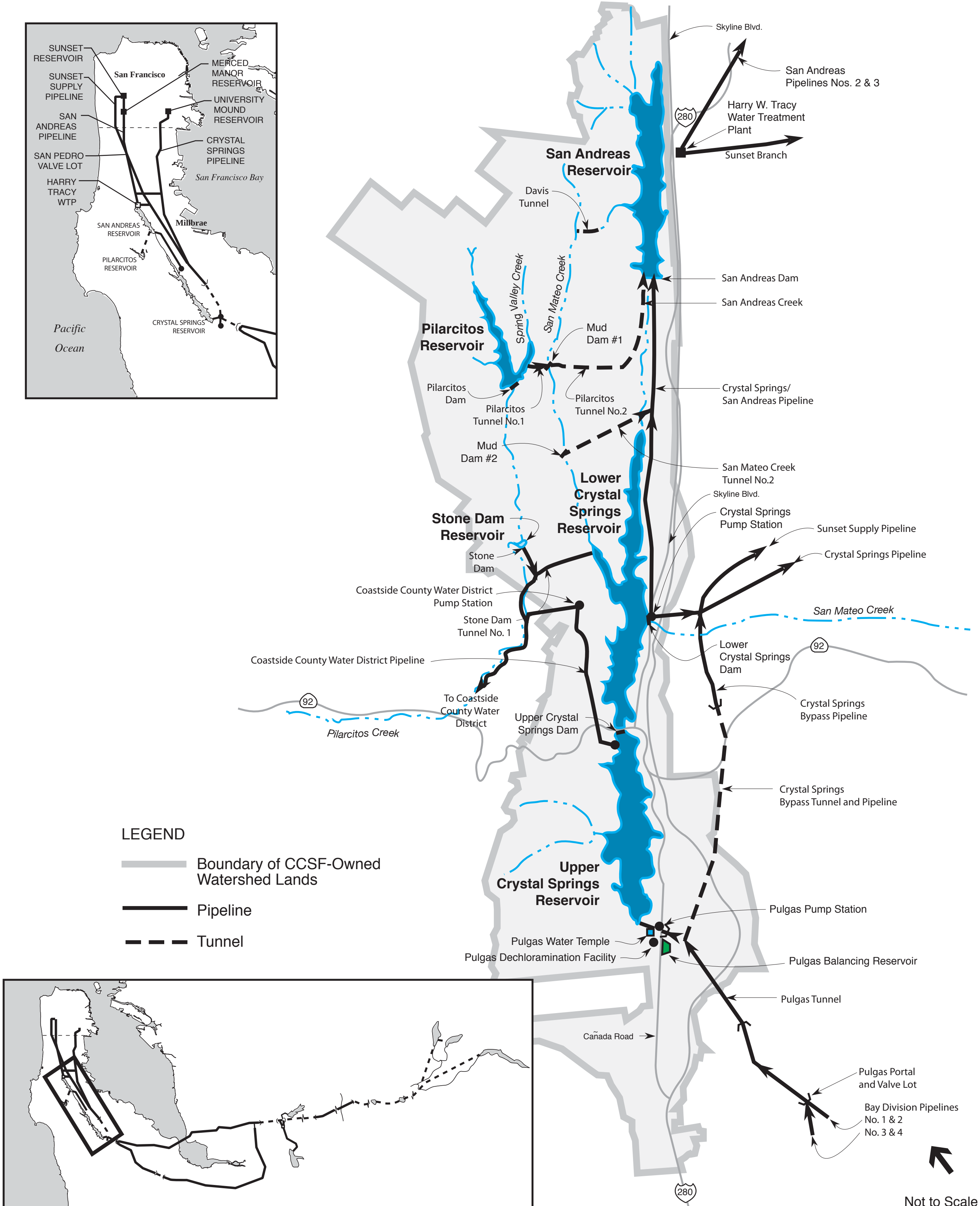
The existing SFPUC intertie with the Santa Clara Valley Water District (SCVWD) is also part of the Bay Division facilities and serves as a means to transfer water between the SFPUC and SCVWD during an emergency or during periods of planned maintenance work on critical facilities. The SFPUC intertie with the East Bay Municipal Utility District (EBMUD), which is currently under construction, will also be part of the Bay Division facilities and will serve as a means to transfer water between the SFPUC and EBMUD during an emergency or during periods of planned maintenance work on critical facilities. The actual water to flow through either intertie is not implicitly part of the operating agreements for the interties, and any exchange must occur under separate agreement by the SFPUC and the SCVWD or EBMUD.

The SCVWD intertie is located near Milpitas Boulevard in Milpitas. This intertie has a capacity of 40 mgd and has been used twice in the past to transfer a total of approximately 2 billion gallons of water from the SFPUC to SCVWD when the latter experienced shutdown of its Penitencia plant. The SCVWD is currently returning supplies to the SFPUC at an average rate of 5 mgd through the intertie.

The EBMUD intertie project includes a pump station at the Hayward Executive Airport, 1.5 miles of new pipeline, improvements to the City of Hayward's pipelines, and other modifications to the existing system that allow for the flow of up to 30 mgd. The project is scheduled for completion in June 2007.

2.2.5 Peninsula Facilities

At the Pulgas Portal and Valve Lot, Hetch Hetchy water supplies combined with treated Alameda watershed supplies enter the Peninsula system through the two-mile-long Pulgas Tunnel (built in 1926). The Peninsula system contains some of the oldest facilities in the regional system and includes three reservoirs—Crystal Springs (comprising the upper and lower reservoirs), Pilarcitos, and San Andreas Reservoirs—as well as the Harry Tracy WTP and extensive transmission facilities. The Peninsula watershed refers to the CCSF-owned lands and includes large portions of the natural drainage area of San Mateo, Pilarcitos, and San Andreas Creeks. **Figure 2.3** shows a schematic of the Peninsula watershed facilities.



SOURCE: San Francisco Planning Department, 2001

SFPUC Water System Improvement Program . 203287

Figure 2.3
Peninsula Watershed Facilities

From Pulgas Tunnel, the Peninsula system splits into two flow streams: one flow stream goes north along the east side of the Peninsula to the Crystal Springs Bypass system and the other west to Crystal Springs Reservoir. Generally, the bulk of the flow from Pulgas Tunnel goes directly into the 3.4-mile-long Crystal Springs Bypass Tunnel (constructed in 1969). The water flows to the 4,500-foot-long Crystal Springs Bypass Pipeline (also constructed in 1969). The Crystal Springs Bypass Pipeline connects to either the Crystal Springs Pipeline or Sunset Supply Pipeline, which convey water to users in northern San Mateo County and San Francisco. Up to this point, the water from Hetch Hetchy Reservoir is delivered entirely by gravity for over 120 miles; water conveyed through the Sunset Supply Pipeline and Crystal Springs Pipeline continues to flow by gravity north up the Peninsula, eventually ending at University Mound Reservoir in San Francisco.

A portion of water from the Pulgas Tunnel flows into Crystal Springs Reservoir, with flows regulated as necessary to meet customer demand through use of the Pulgas Balancing Reservoir and Pulgas Pump Station. Prior to discharge to Crystal Springs Reservoir, chloramine is removed from the combined Hetch Hetchy and Alameda watershed flows and the pH is adjusted at the Pulgas Dechloramination Facility in order to meet regulatory discharge requirements and to protect the water quality in the reservoir (SFPUC, 2004).

Crystal Springs Reservoir is where Hetch Hetchy and Alameda watershed water supplies blend with local water sources from the Peninsula watershed. Originally constructed as two separate reservoirs for the Spring Valley Water Company, Crystal Springs Reservoir is composed of Upper and Lower Crystal Springs Reservoirs. As constructed, Upper Crystal Springs Dam, built in 1877, divided the two reservoirs; however, since 1924, two large culverts through the dam enable unregulated flow between the reservoirs. Upper Crystal Springs Dam also forms the roadbed for State Highway 92, which crosses Crystal Springs Reservoir. Lower Crystal Springs Dam, originally built in 1888 and raised in 1891 and 1911, is located on San Mateo Creek; San Mateo County subsequently built a bridge over the crest of the dam.

Since 1983, the DSOD has placed operational restrictions on Lower Crystal Springs Dam due to concerns regarding the ability of the dam to retain water during major flood events. The DSOD operating restrictions have reduced the historical capacity of the combined Crystal Springs Reservoir by about 15 percent (see Table 2.2 for historical and restricted reservoir capacities). For the past 23 years, the SFPUC has adjusted its operating procedures to comply with the DSOD restrictions.

Crystal Springs Reservoir impounds local drainage from the surrounding lands, including the upper San Mateo Creek drainage northwest of the reservoir, as well as inflow from Pulgas Tunnel, which delivers water from the Hetch Hetchy and Alameda watersheds to the reservoir. In addition, local water supplies from Stone Dam Reservoir on Pilarcitos Creek (discussed below) are conveyed to and stored in Crystal Springs Reservoir. The Crystal Springs Pump Station (built in 1933) pumps water stored in Crystal Springs Reservoir through the Crystal Springs/ San Andreas Pipeline to San Andreas Reservoir. This pipeline was originally built between 1898 and 1932, then largely rebuilt in 1968, although it still retains elements from the 1898 to 1932 era.

San Andreas Reservoir also receives water from Pilarcitos Reservoir (described below), but its primary source of water is Crystal Springs Reservoir. Water in San Andreas Reservoir is treated at the Harry Tracy WTP (also discussed below) before transmission to the regional system and delivery to customers.

Pilarcitos Dam was built in 1866 and raised in 1874; it collects local drainage and water from the Pilarcitos Creek watershed, forming Pilarcitos Reservoir. Stone Dam was built in 1871, two miles downstream of Pilarcitos Dam, capturing drainage along Pilarcitos Creek below the dam. Water from Pilarcitos Reservoir can be diverted to San Andreas and Crystal Springs Reservoirs through a system of tunnels originally built at the end of the 19th century. Almost half of Pilarcitos Reservoir supply is used to serve the Half Moon Bay area through wholesale service to the Coastside County Water District (Coastside CWD).

San Andreas Reservoir was originally constructed in 1870 to collect drainage from the San Andreas Creek watershed. Today, San Andreas Reservoir serves as the terminus for the multiple water sources collected in the Peninsula storage reservoirs. It receives inflow from Pilarcitos Reservoir, San Mateo Creek drainage, and Crystal Springs Reservoir (including Hetch Hetchy and Alameda watershed water stored in Crystal Springs Reservoir, which is conveyed through the Pulgas Tunnel). San Andreas Reservoir is the source of raw water inflow to the Harry Tracy WTP.

The Harry Tracy WTP, formerly known as the San Andreas Filter Plant, was built in 1971 and expanded in 1988 and 1990. It provides filtration, fluoridation, and disinfection for water collected in all of the Peninsula reservoirs. The plant has a hydraulic capacity of 180 mgd; however, in recent years the SFPUC has come to consider its sustainable capacity to be 120 mgd. Additionally, during most winters, San Andreas Reservoir experiences blooms of filter-clogging algae that can limit plant production to 90 to 100 mgd for several weeks.

Treated water from the Harry Tracy WTP is delivered to customers in northern San Mateo County and San Francisco through turnouts along the system. Several valve lots used to regulate flow and provide operational flexibility are located along the pipeline alignment between the Harry Tracy WTP and San Francisco, including the Capuchino, Baden, and San Pedro Valve Lots. Water from the Harry Tracy WTP is eventually delivered via the San Andreas Pipelines Nos. 2 and 3 or the Sunset Branch Pipeline to the Sunset or Merced Manor Reservoir in San Francisco, the final destination of this portion of the regional water system (SFPUC, 2004).

2.2.6 San Francisco Regional Facilities

The regional water system ends in San Francisco, where it connects to the city's local distribution system. There are three pipeline systems and three terminal reservoirs in this part of the regional system.

The three regional pipeline systems transporting water from the Peninsula to San Francisco are the Sunset Supply Pipeline, Crystal Springs Pipelines, and San Andreas Pipelines. The Sunset Supply and Crystal Springs Pipelines both extend about 20 miles from the Crystal Springs Bypass

Pipeline near Hillsborough to the Sunset and University Mound Reservoirs in San Francisco, respectively. The Crystal Springs and Sunset Supply Pipelines lines are referred to as “low zone” facilities, meaning that they operate on the Hetch Hetchy gradient, flowing by gravity from the Sierra all the way to San Francisco. Portions of these pipelines were built over 100 years ago and are still in service. The San Andreas Pipeline Nos. 2 and 3 start at the Harry Tracy WTP and deliver water to the Sunset and Merced Manor Reservoirs. These pipelines were designed to transmit water from San Andreas Reservoir to San Francisco; they are referred to as the “high zone” pipelines because the elevation of this part of the system on the Peninsula is about 150 feet higher than the low zone facilities. Water can be transferred between pressure zones at the Baden Pump Station (from low to high) and at the Capuchino Valve Lot (from high to low). Water is distributed to wholesale and a few retail customers in San Francisco and San Mateo Counties through turnouts along all three regional pipeline systems.

The three terminal reservoirs of the regional system are the Merced Manor, Sunset, and University Mound Reservoirs. Merced Manor and Sunset Reservoirs are on the west side of San Francisco. Merced Manor Reservoir, built in 1936, has a capacity of 9.5 million gallons. Sunset Reservoir–North Basin (built in 1938) and Sunset Reservoir–South Basin (built in 1960) have a combined capacity of about 177 million gallons. On the east side of San Francisco, University Mound–North Basin (built in 1924) and University Mound–South Basin (built in 1937) have a combined capacity of about 140 million gallons. The three terminal reservoirs in the regional system provide water for retail customers in San Francisco and regional system storage for wholesale customers on the Peninsula (SFPUC, 2004).

2.3 Water System Operations and Maintenance

System operations involve a complex interaction of numerous factors, including the capacity and operating conditions of physical facilities, customer needs, meteorological and hydrologic conditions, regulatory requirements, and institutional constraints. This section briefly discusses system customers, water supply sources, water quality, operational requirements, normal system operations for water deliveries, operations during drought periods, system maintenance, hydropower operations, and watershed management.

2.3.1 System Customers

The SFPUC provides water delivery services to retail and wholesale customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties that serve a total of about 2.4 million people. The SFPUC serves about one-third of its water supplies directly to retail customers located primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers, primarily in the South Bay and Peninsula, by contractual agreement. Chapter 3 provides more detailed information on system customers, including a map of the service area (Figure 3.2), a list of retail and wholesale customers (Table 3.1), and a summary of current customer purchases from the regional system (Table 3.4).

2.3.2 Water Supply Sources

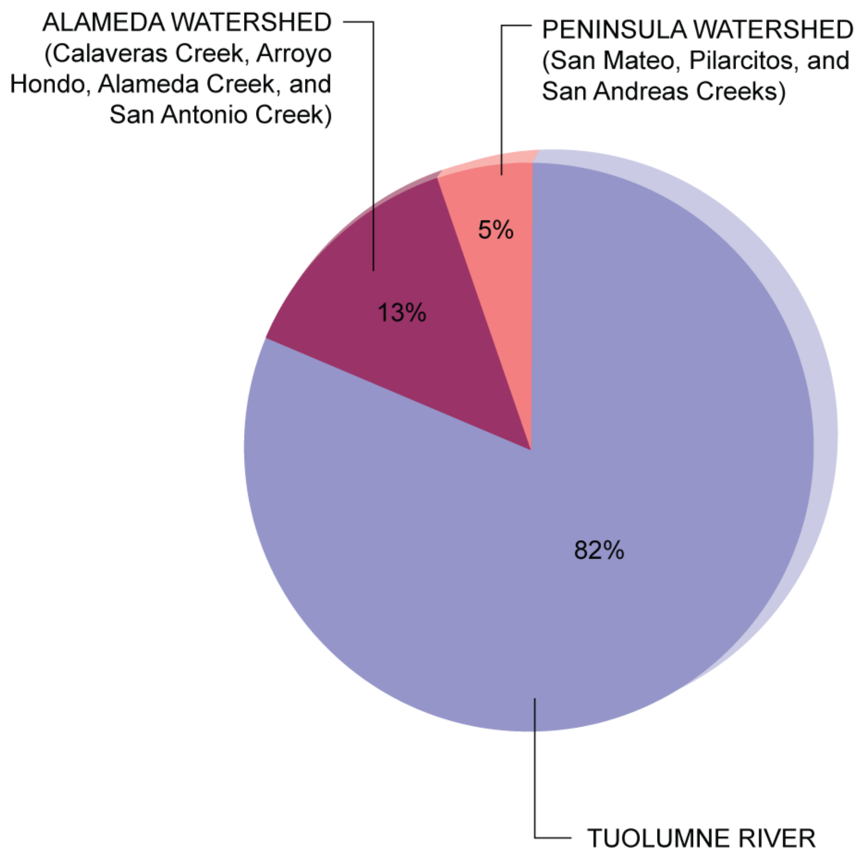
The SFPUC currently delivers an annual average of about 265 mgd through the regional water system. As described above, a majority of the water for the regional system comes from the Tuolumne River; this water is used to augment water supplies from local creeks and runoff in the Alameda and Peninsula watersheds. Local creeks and runoff in the local Alameda and Peninsula watersheds provide an average of about 15 percent of the total water supply. The Tuolumne River provides an average of about 85 percent to make up the remainder of the total water supply needed by customers.

In the Alameda watershed, the creeks feeding the local reservoirs include Arroyo Hondo and Alameda, Calaveras, and San Antonio Creeks; on the Peninsula, the major local water sources are San Mateo, Pilarcitos, and San Andreas Creeks. **Figure 2.4** illustrates the general breakdown of current water sources for the regional water system to meet all customer purchase requests for a typical year with adequate rainfall and snowmelt conditions. However, during extended dry periods, the regional system currently does not have a sufficient water supply, stored water, or supplemental water sources to fully meet customer purchase requests. Depending on the severity and duration of the drought condition, the SFPUC implements customer rationing (see the detailed discussion in Section 2.3.5), as occurred during the 1987–1992 drought. **Figure 2.5** depicts the breakdown of water sources and customer rationing that could occur under existing conditions during an extended drought sequence (see Chapter 3, Sections 3.4.1 and 3.5.4 for discussion of assumptions and planning tools, such as design drought and system firm yield, used in determining drought-year water supply needs).

2.3.3 Water Quality

The SFPUC regional water system delivers extremely high-quality water. As shown in Figure 2.4, the majority of the water is from the Tuolumne River, which originates in the upper Tuolumne River watershed high in the Sierra Nevada, remote from human development and pollution. This pristine water, referred to as Hetch Hetchy water, is delivered through pipelines and tunnels to the Bay Area and requires only minimal treatment (disinfection and pH adjustment) before it is served to customers. The U.S. EPA and DHS have approved the use of this drinking water source without requiring filtration at a treatment plant, as is generally required by the Surface Water Treatment Rule. However, in the event that water originating from Cherry and Eleanor Creeks is diverted to the regional water system, filtration of all water delivered from the Hetch Hetchy system would be required.

Local water supplies from the Alameda and Peninsula watersheds are subject to the Surface Water Treatment Rule, which specifies filtration requirements to meet drinking water quality standards. Filtration of Alameda and Peninsula water supply sources occurs at the Sunol Valley and Harry Tracy WTPs, respectively. Filtered and treated water from local watersheds is blended with Hetch Hetchy water, and all customers west of Sunol receive blended water. System water quality, including both raw and treated water quality, is continuously monitored and tested to assure that water delivered to customers meets or exceeds federal and state drinking water and public health requirements.



Note: Water supply sources (average annual) based on 2005 conditions during nondrought years, with Calaveras Reservoir operating at restricted levels and with 265 mgd in total systemwide deliveries.

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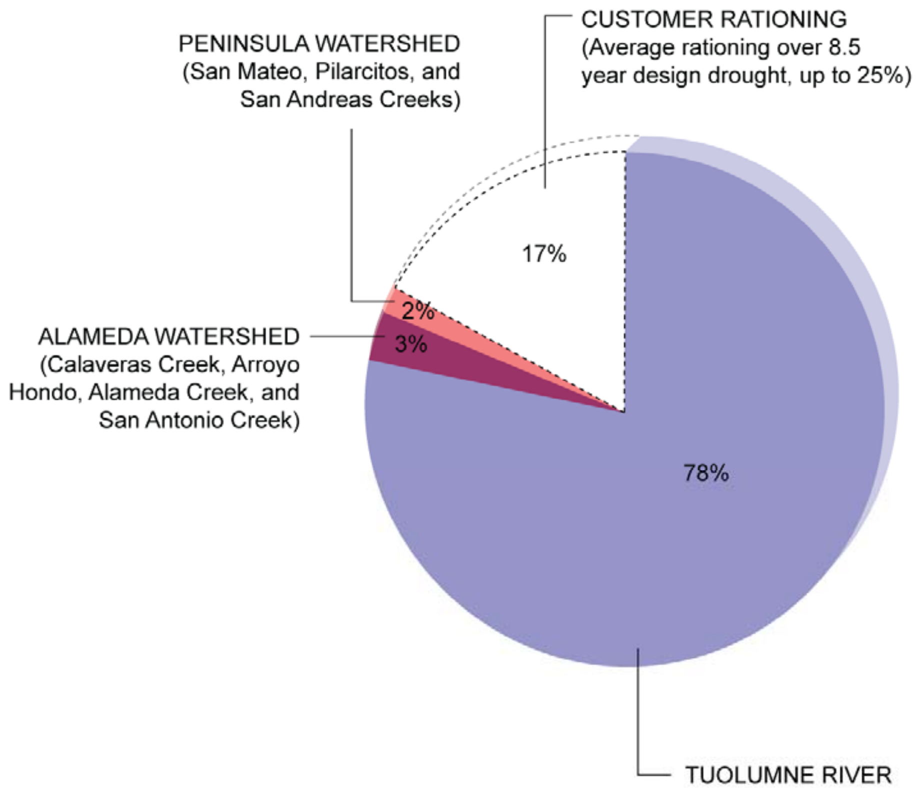
Figure 2.4
Existing Water Supply Sources, Typical Years

2.3.4 Normal System Operations for Water Deliveries

The SFPUC's Water First Policy gives priority to the production and protection of water supply over the production of hydropower generation in the operation of the Hetch Hetchy system. The Water First Policy was adopted in California in 2002 as part of the Wholesale Regional Water System Security and Reliability Act (Assembly Bill No. 1823), but has been the operational practice of the SFPUC since 1993 (Moran, 1994). Water quality is also a priority over hydropower operations that originate out of Hetch Hetchy Reservoir because of the need to meet drinking water permit requirements. The Water First Policy is further discussed in Section 2.4.3, below.



Note: Water supply sources (average annual) over 8.5-year design drought based on 2005 conditions, with Calaveras Reservoir operating at restricted levels and with 265 mgd in total systemwide deliveries. The chart depicts the expected level of water supply and rationing that could occur under these conditions.

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Figure 2.5
Existing Water Supply Sources, Dry Periods

Operation of the regional water system can be generally delineated between rules and strategies affecting the operation of the local system of reservoirs (in the Alameda and Peninsula watersheds) and rules and strategies affecting the operation of the Hetch Hetchy system. Although generally discussed separately, the two systems are interdependent, and operations of the systems are integrally linked in order to maximize water availability and quality. Schematic diagrams showing the linkage of system facilities that determine system operations are presented in **Figure 2.6**.

SFPUC customer purchase requests are met through a combination of flows from the Hetch Hetchy system and local reservoirs. The SFPUC operates the local reservoirs to conserve local watershed runoff and diverts water from the Hetch Hetchy system to supplement the supply developed by the local reservoirs. The overriding operating goal of meeting system demand is to ensure that sufficient water is available year-round regardless of hydrologic conditions (drought or nondrought).

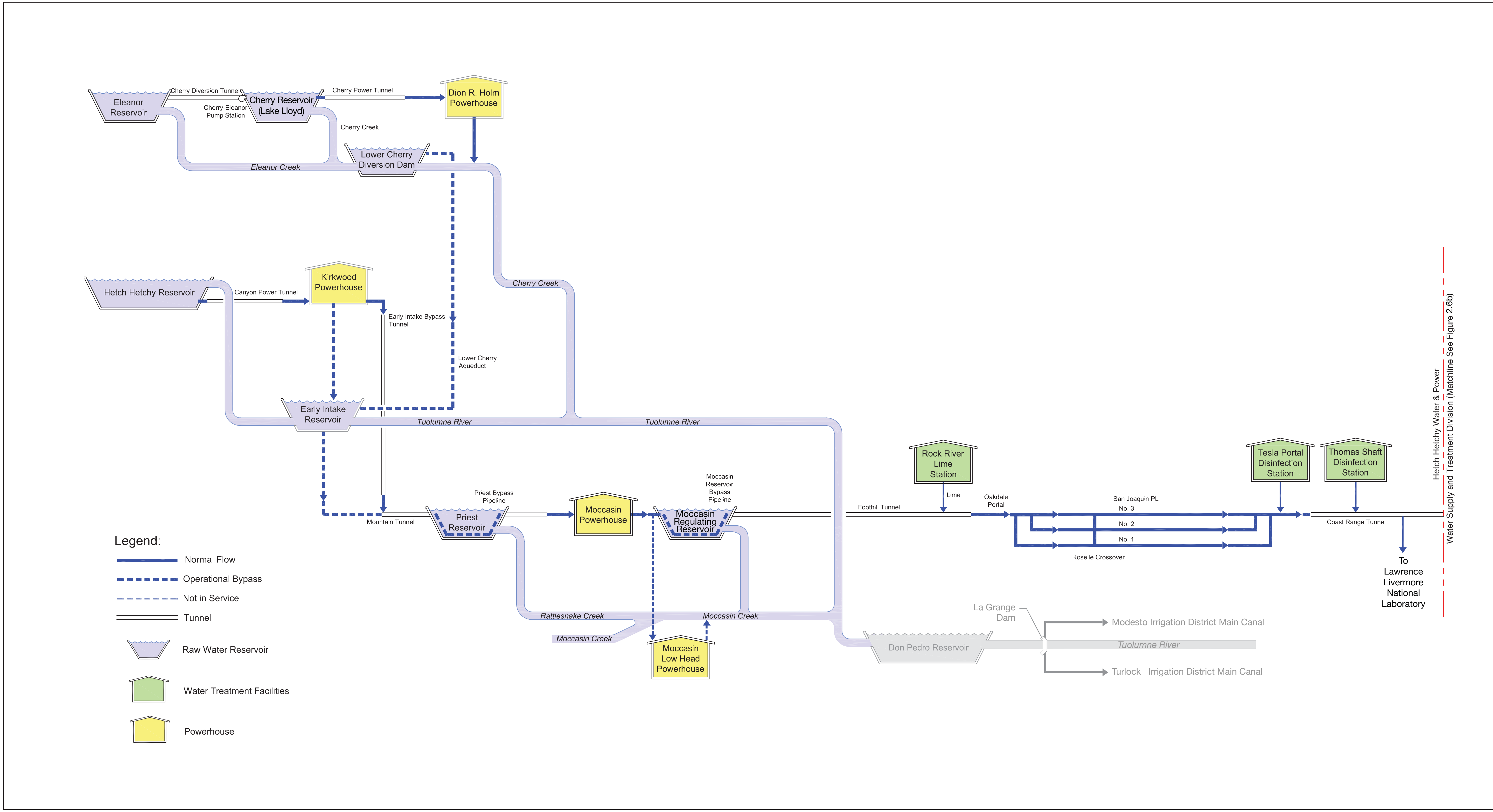
System operations and the amount of water delivered to customers vary throughout the year based on seasonal demand and the availability of water. The availability of water for delivery to customers is affected by numerous factors, including meteorological and hydrologic conditions; the capacity and operating condition of physical facilities and infrastructure; and regulatory/institutional parameters that regulate and allocate the distribution of water from the various sources. Regulatory requirements applicable to the regional system are described in Section 2.4, and institutional parameters, including system operations required to meet downstream obligations, are discussed in Section 2.5. This section describes system operations to meet customer water demand under normal conditions (i.e., in years when water supplies from rainfall, snowmelt, and storage are sufficient to fulfill customer purchase requests without rationing).

Water in the Hetch Hetchy system (which includes Hetch Hetchy Reservoir, Lake Lloyd and Lake Eleanor) comes from a combination of rainfall and inflow from the melting snowpack in the Tuolumne River watershed. The majority (approximately 80 percent) of the inflow to the reservoirs occurs during the snowmelt period from April through July. The SFPUC integrates the operation of its three Tuolumne River reservoirs with the operation of the water bank account in Don Pedro Reservoir (for an explanation of the water bank account, see Sections 2.4 and 2.5, below, regarding the Raker Act and New Don Pedro Project). The operation of these reservoirs and the water bank account is guided by two primary objectives: (1) conserve Hetch Hetchy Reservoir storage for diversion to meet the water purchase needs of SFPUC customers, and (2) fulfill the SFPUC's obligations to TID and MID under the Raker Act. There are also minimum downstream release requirements prescribed by the resource agencies (described in Section 2.5.3, below) for Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor.

The primary objective of Hetch Hetchy Reservoir operation is to maximize the volume of water stored in the reservoir by July 1 of every year (referred to as "carryover storage"[3]). After July 1, typically the end of snowmelt season, Hetch Hetchy Reservoir levels decline as diversions to the Bay Area exceed inflow to the reservoir.

Diversions from the Tuolumne River primarily originate from Hetch Hetchy Reservoir and incidentally provide hydroelectric generation at Kirkwood and Moccasin Powerhouses, in keeping with the SFPUC's Water First Policy. In general, the SFPUC avoids large downstream releases immediately below Hetch Hetchy Reservoir by regulating inflow and making smaller controlled releases from the reservoir. In anticipation of snowmelt runoff, the SFPUC releases water from Hetch Hetchy Reservoir by sending water through Kirkwood Powerhouse, thus lowering the level of the reservoir and reducing the storage volume to allow room for inflow from snowmelt runoff. This reduction in storage normally begins in winter as forecasts of snowmelt runoff become available. Drawdown of reservoir storage is determined first by the releases needed to meet water demand and second by the capacity of Kirkwood Powerhouse. If

[3] Carryover storage is storage in a reservoir that is available for use in a succeeding period. For the SFPUC system, it is normally defined as the reservoir storage on July 1 of a given year. Carryover storage is a measurement of excess water captured when water is available, such as during the rainy season or during wet years, which is then available for later use during the dry season and/or during dry years.



SOURCE: Olivia Chen Consultants, 2005; SFPUC, 2007; ESA + Orion, 2007

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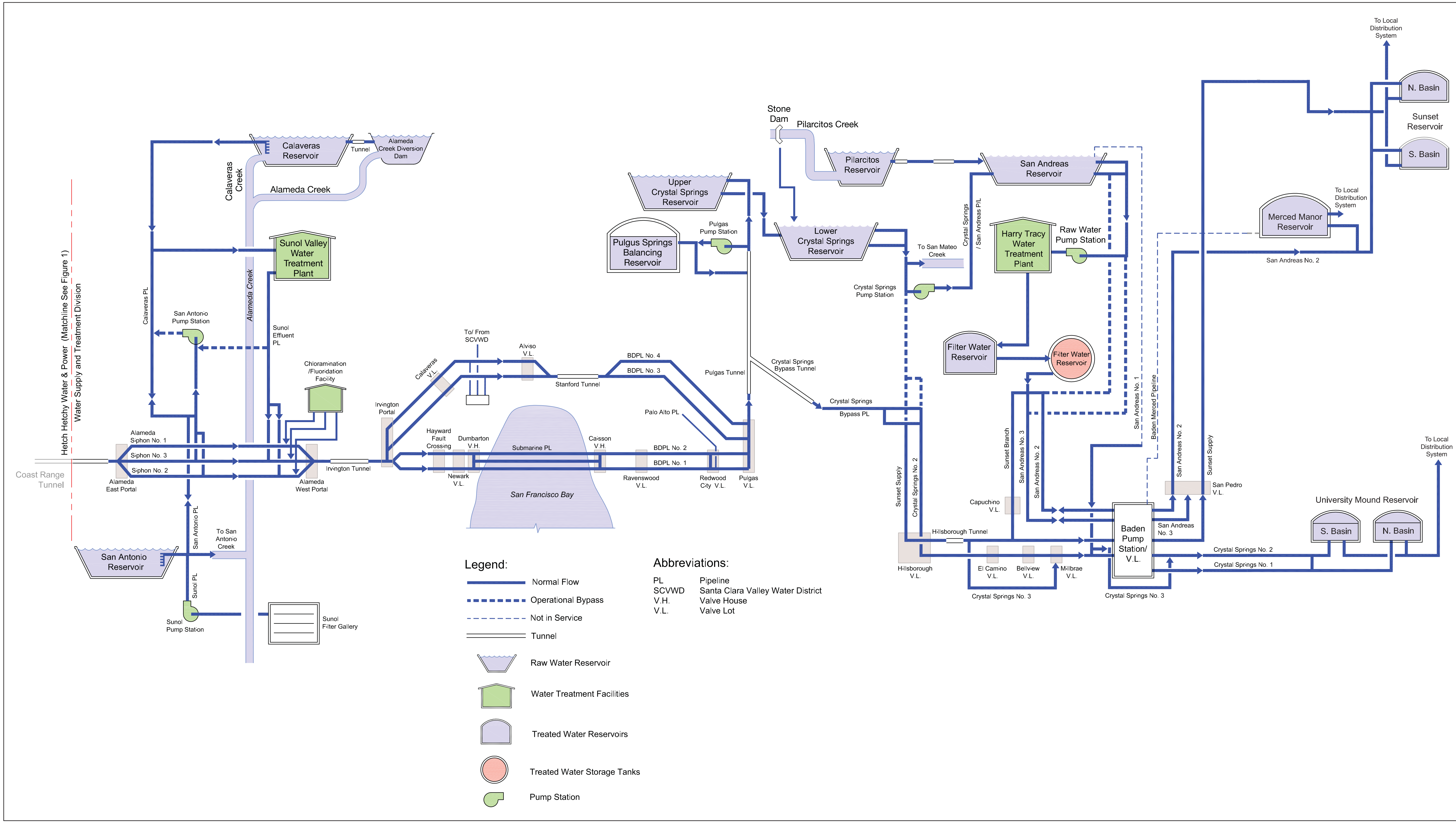
Figure 2.6a
Schematic Diagram of Regional System Facilities Linkages, Hetch Hetchy to Tesla



SOURCE: Olivia Chen Consultants, 2005; SFPUC, 2007; ESA + Orion, 2007

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Figure 2.6b
Schematic Diagram of Regional System Facilities Linkages, Tesla to San Francisco

determined necessary due to hydrologic conditions and reservoir storage capacity, additional controlled releases are made to the river.

Similar to Hetch Hetchy Reservoir operations, the Lake Lloyd and Lake Eleanor system is operated to conserve reservoir inflow for both water supply and hydroelectric generation (see Section 2.5). Winter and spring operations rely on the occurrence and forecast of runoff, which at times allows the SFPUC to drawdown reservoir storage in Lake Lloyd and Lake Eleanor and to utilize Holm Powerhouse for hydropower generation. The water transfer capability from Lake Eleanor to Lake Lloyd through the Eleanor-Cherry Diversion Tunnel, which links the two watersheds, allows for the utilization of runoff from the Eleanor Creek watershed through Holm Powerhouse. Like Hetch Hetchy Reservoir, maximum carryover storage into the summer season is the primary objective for reservoir operations.

As previously stated, the primary operating strategy is to fill all Hetch Hetchy system reservoirs on or about July 1 of each year. Historically, this occurs in about 75 percent of years, and generally by April 15 of each year the SFPUC can project the amount of water that will be stored in the system by July 1 of that year.

Operation of the Hetch Hetchy system is integrally linked with and dependent on the local system in the Alameda and Peninsula watersheds, as the Hetch Hetchy supply is used to supplement local supplies. While the Hetch Hetchy system provides the majority of the water (about 85 percent on average), the local reservoirs are operated to maximize use of annual yield for water deliveries and to provide critical backup or redundancy in the event of water quality problems, transmission disruptions in the Hetch Hetchy system, emergencies, critical maintenance, and droughts. Local water supplies stored in Calaveras Reservoir are the system's primary backup to the Hetch Hetchy supply. San Antonio and Crystal Springs Reservoirs supplement the storage capacity of Hetch Hetchy Reservoir, since the regional system conveys water from Hetch Hetchy Reservoir for storage in these local reservoirs; Calaveras Reservoir, however, stores only local watershed supplies and does not supplement the storage capacity of Hetch Hetchy Reservoir. The system is operated to maximize use of local resources for annual water deliveries, drought supply, and emergencies. Carryover storage in local reservoirs is critical to support system maintenance and emergency and drought preparedness of the regional water system (SFPUC, 2005a).

When water in excess of customer demand is available from Hetch Hetchy Reservoir and there is available capacity in the transmission system and local reservoirs, the SFPUC diverts water from the Hetch Hetchy system for storage in local reservoirs, namely San Antonio Reservoir in the Sunol Valley and Crystal Springs Reservoir on the Peninsula;[4] this "topping off" or replenishment operation also develops carryover storage in the regional system. Replenishment of local reservoirs is part of the overall strategy for maximizing the locally available water supply. The operational goal is to replenish storage in local reservoirs following the end of the rainy season, if necessary to supplement inflow from the local watershed, with water conveyed from the Hetch Hetchy system.

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4 The regional system is designed so that Calaveras and Pilarcitos Reservoirs are used exclusively to store water from local drainages; they are not used to store water from the Hetch Hetchy system.

The SFPUC operates the local reservoir system to manage water needed for customer deliveries, water captured from local watershed runoff, and water conveyed from the Hetch Hetchy system. A primary objective of the local reservoir system is to conserve local watershed runoff for delivery. The local reservoir system's operation is seasonally driven. During the winter, when rainfall and local watershed runoff occurs, the local reservoirs are managed to maintain sufficient available storage and to minimize uncontrolled spills. In anticipation of or subsequent to storm events, runoff is conveyed to the Harry Tracy and Sunol Valley WTPs to maintain reservoir storage at winter storage objective levels. Towards the end of the winter as the likelihood of rain decreases, the reservoirs are operated to capture local watershed runoff with a goal of maximizing carryover storage in combination with Hetch Hetchy system storage.

During the summer, the amount of water drawn from the local reservoirs is minimized to preserve storage so that water is available in the event of a disruption of flow from Hetch Hetchy Reservoir or unplanned outages within the system. As the system demand increases beyond the capacity of flow from the Hetch Hetchy system, water is drawn from the local reservoirs to serve demand.

While the local watershed systems all have a common overall operating strategy, aspects of the Calaveras and Pilarcitos Reservoirs in the local system have a component of unique operation. As previously stated, Calaveras Reservoir's inflow is supplemented by diversions from Alameda Creek through the Alameda Creek Diversion Tunnel. Typically, the tunnel diverts flow from upper Alameda Creek when it is available up to the capacity of the tunnel. Flow at the diversion site that exceeds the diversion capacity spills over the dam and into the reach of the creek downstream of the diversion dam. Prior to 2002, the tunnel was kept open throughout the entire rainy season except when Calaveras Reservoir was full. Since 2002 with the DSOD restriction in place, the SFPUC has closed the tunnel more often, since Calaveras Reservoir is operated at reduced storage capacity. In addition, the SFPUC recently installed a low-flow valve at Calaveras Dam to allow for future low-flow releases.

Pilarcitos Reservoir stores runoff from the Pilarcitos Creek watershed for transfer to the SFPUC's reservoir in the San Mateo Creek watershed and for use by Coastside CWD. Water for Coastside CWD is released from Pilarcitos Reservoir to Pilarcitos Creek and then diverted by Coastside CWD at Stone Dam. Pilarcitos Reservoir is filled during the rainy season. Water not needed to fill the reservoir and meet Coastside CWD's needs is transferred from Pilarcitos Reservoir to San Andreas Reservoir and from Stone Dam to Crystal Springs Reservoir. Occasionally during wet months of wet years, runoff exceeds Coastside CWD's needs and the ability of the SFPUC to store water in Pilarcitos Reservoir or convey it to San Andreas and Crystal Springs Reservoirs. At such times, water spills over Stone Dam and flows down Pilarcitos Creek. In the summer months, when Coastside CWD's water demand is at its seasonal maximum, its water supply from Pilarcitos Creek becomes insufficient to meet its needs. At that point, Coastside CWD ceases diversions from Pilarcitos Creek and obtains its water by pumping from Crystal Springs Reservoir. The SFPUC is currently making experimental releases from Stone Dam to support ongoing studies of aquatic resources in Pilarcitos Creek below Stone Dam.

None of the Peninsula system reservoirs currently have regulatory agreement for an instream release immediately below their dams (see Section 2.5 for further discussion). Both San Mateo Creek downstream of Crystal Springs Reservoir, and Pilarcitos Creek below Stone Dam, have limited channel capacity due to urban (San Mateo Creek) and agricultural (Pilarcitos Creek) encroachments. Therefore, both reservoirs are operated to minimize uncontrolled reservoir spills. Calaveras Reservoir is the only reservoir in the Alameda system that has an instream release agreement; this agreement is pursuant to a 1997 Memorandum of Understanding (MOU) with the CDFG (see Section 2.5 for further discussion) (CDFG, 1997).

As described above, the regional system is highly dependent on storage, both in the Sierra Nevada and locally in the Bay Area, to be able to serve water under a wide variety of meteorological/ hydrological and operating conditions. During system upsets or when unusual water quality conditions occur in any of the reservoirs, the system provides a number of operational bypasses (see Figure 2.6) and backup facilities that allow the SFPUC to modify normal operations and continue to meet water quality standards without interrupting service to its customers.

2.3.5 Operations During Drought Periods

System operations during drought periods require more complex planning and system management than during nondrought years. Drought planning relies on two key concepts: “system firm yield” and “design drought.” System firm yield is the average annual water delivery that can be sustained throughout an extended drought. Design drought is a planning and operation tool that water supply agencies use to define a reasonable worst-case drought scenario based on local hydrology in order to establish design and operating parameters for the water system. Droughts more severe than the design drought would cause failure of supply within the water system. For the purposes of regional water system planning, the SFPUC uses a design drought that anticipates and plans for a more severe drought than historical events and evaluates the system firm yield assuming the system is experiencing the design drought. Studies suggest a 30 percent chance that the SFPUC system will experience a drought in the next 75 years equal to or more severe than the 1987–1992 drought, which was the most extreme recorded drought event to affect the regional system. The WSIP uses a design drought based on the hydrology of the six years of the worst historical drought (1987–1992) plus the 2.5 years of the 1976–1977 drought, for a combined total of an 8.5-year design drought sequence (SFPUC, 2007a).

With the DSOD restriction on Lower Crystal Springs Dam but no restriction on Calaveras Dam, the system firm yield is 226 mgd; this represented system conditions prior to December 2001. However, currently, due to the existing DSOD operating restriction on Calaveras Dam since December 2001, the system firm yield is reduced to about 219 mgd. The regional system currently provides an annual average of about 265 mgd of water to customers. Since the current deliveries (265 mgd) are greater than the system firm yield (226 mgd under normal conditions or 219 mgd under restricted conditions), the regional system cannot fully meet water deliveries to current customers during a prolonged drought. Reductions in deliveries (i.e., customer rationing) are required during drought periods (SFPUC, 2007a), as indicated in Figure 2.5.

The regional system has experienced drought periods in the last 30 years: most notable are the droughts that occurred from 1976 to 1977 and from 1987 to 1992. During the 1987–1992 drought, even with the implementation of customer rationing, the amount of carryover storage in the regional system was more severely depleted than during any previous time, and the SFPUC had to adjust its normal operating procedures to avoid running out of water (SFPUC, 2007a).

The 1987–1992 drought began at the end of the 1986 rainy season. Subsequent annual flows in the Tuolumne River were about 50 percent of average, CCSF entitlements were reduced to about 16 percent of the total river flow, and less than 50 percent of the normal amount of water delivered to customers was available from the river. As the drought progressed, the SFPUC developed and implemented short-term procedures to impose rationing on customers that resulted in a near 25 percent annual systemwide[5] reduction in water deliveries. The extended drought forced the SFPUC to adopt a mandatory rationing program from 1988 to 1989 and again from 1990 to 1993. The rationing program was based on an allocation method that reduced indoor water uses by 10 percent and outdoor water uses by 60 percent. However, due to the wide variation in types of water users in the regional service area, this program resulted in a wide variation in the cutbacks experienced by different customers, ranging from about 20 percent in areas with cooler climates and denser land use patterns to over 40 percent in areas with warmer climates and more landscaping. In the later stage of the six-year drought, the SFPUC was initiating programs to achieve a 45 percent reduction in systemwide water deliveries to balance water supplies with deliveries, but a series of storms in March 1991 provided relief from the anticipated water shortage, and the 45 percent rationing program was averted. However, based on the experience of the 1987–1992 drought, the SFPUC modified its operational procedures with regard to drought planning (SFPUC, 1993).

In 2000, the SFPUC adopted the *Interim Water Shortage Allocation Plan* (SFPUC, 2000a) in collaboration with the Bay Area Water Users Association (the organization representing wholesale customers, which has since been reorganized as the Bay Area Water Supply and Conservation Agency, or BAWSCA). This plan identified a water allocation method to be used to determine the share of water for wholesale customers during shortages caused by drought. The allocation method is effective for systemwide shortages of up to 20 percent during droughts. Following the adoption of the *Interim Water Shortage Allocation Plan* by all of the wholesale customers, the SFPUC adopted the *Retail Water Shortage Allocation Plan* consistent with the plan for wholesale customers (SFPUC, 2001b), which applies to all retail customers, including the residents and businesses in San Francisco.

Based on the two water allocation plans, the SFPUC system operations currently include a process for declaring a water shortage and a method for allocating reductions. The general protocol links total and anticipated reservoir storage conditions to suggested delivery reductions. Each year, during the spring snowmelt period, the SFPUC evaluates the amount of total water storage expected to occur throughout the regional system. If this evaluation finds the projected

[5] For the purposes of this PEIR, “systemwide” refers to the entire regional water system and includes both retail and wholesale customers.

total water storage to be less than an identified level sufficient to provide sustained deliveries during drought, the SFPUC may impose delivery reductions or rationing. With existing purchase requests, there are currently three stages of delivery reduction: Stage 1 involves up to a 10 percent systemwide delivery reduction and is achieved by voluntary rationing; Stage 2 imposes up to a 20 percent systemwide delivery reduction and requires mandatory rationing; and, at Stage 3, a 20 percent or greater systemwide delivery reduction would result in mandatory rationing with further reduced allocations. As drought conditions continue and reservoir storage becomes further depleted, the SFPUC may need to impose an increasing level of delivery reductions. Prior to the initiation of any water delivery reductions, the SFPUC would hold a public meeting, open for public comment, to outline the water supply situation, the proposed water use reduction objectives, alternatives to water use reduction, and compliance methods (SFPUC, 2001b).

2.3.6 System Maintenance

The SFPUC performs maintenance of the regional system facilities as a fundamental part of operations so that it can continue to serve customers with reliable, high-quality water. Maintenance can include inspections and minor repairs/upkeep as well as major repairs, replacement, or rehabilitation. One of the inherent difficulties with performing maintenance on existing system facilities is that the most important facilities to maintain are also the most critical for system operation and, therefore, the most difficult to take out of service for inspection or repair. Planned outages for system inspections and repair must be scheduled in the context of the ongoing need to meet customer demand and maintain storage levels in local reservoirs. Pipelines, tunnels, treatment and pumping facilities, and other related facilities all require maintenance. Pipelines and tunnels have the greatest operational constraints with respect to maintenance because they need to be shut down during maintenance. Treatment and pumping facilities have more flexibility, since maintenance can generally be performed on these facilities without completely shutting them down.

Within the regional system, the current goal is to inspect all tunnels, except for the Irvington Tunnel, and all San Joaquin Pipelines on a 10-year cycle. Additionally, certain segments of the San Joaquin transmission system are inspected more frequently based on their age, leak history, condition, etc. Approximately four inspections per year are performed on the Bay Division and Peninsula pipeline sections. Following inspections, minor repairs may require outages of 45 days to two months, while major repairs may require shutdowns of 90 days or more.

The SFPUC attempts to meet the maintenance goals to the extent possible, given the capacity restrictions and limited redundancy (i.e., backup facilities) of the current system. Many of the tunnels in the system are important for water delivery to customers and lack redundancy, so it is difficult to shut them down for inspections. These include the Irvington, Pulgas, Crystal Springs Bypass, and Stanford Tunnels. Some of these tunnels have not been inspected for 20 to 30 years. As described previously, maintenance and inspection of Irvington Tunnel has not occurred for over 40 years.

Despite ongoing maintenance, unplanned outages occur periodically throughout the regional system for various reasons, including power outages and system failures. Major facility failures or outages that have recently occurred include:

- In August 1996, a rupture in SJPL No.3 occurred about 2 miles west of Oakdale Portal due to failure of the pipe material. The pipeline break resulted in reduction of water delivered from the Hetch Hetchy system to the Bay Area from 230 mgd to 150 mgd for a period of three weeks. The pipeline failure caused an unplanned discharge of over 10 million gallons of water at a rate of 200 to 400 cubic feet per second, flooded the surrounding cattle range land, and created a 1,000-foot long erosion gully. The SFPUC issued an emergency repair contract to replace the faulty pipe section and to restore water deliveries, and the surrounding lands were restored to their previous conditions.

- During the 1996/1997 rainy season, a landslide occurred on the hillside above the Crystal Springs Bypass Pipeline, burying a 350-foot segment of the roadway in which the pipeline is aligned. This landslide subjected the pipeline to excessive soil pressure and slight displacement. Although inspections of the pipeline found minor and repairable damage, corrective actions were necessary to stabilize the slope above the pipeline. The incident revealed how vulnerable the Crystal Springs Bypass Pipeline is to seismically induced landslides.

- During the 1996/1997 rainy season, concurrent with the unplanned outage of the Crystal Springs Bypass Pipeline, water in Crystal Springs Reservoir exhibited excessive levels of turbidity that limited the availability of water that could be treated at the Harry Tracy WTP. This condition lasted for about four weeks.

Pipeline leakage or failure is particularly susceptible where there are prestressed concrete cylinder pipe (PCCP) segments. PCCP breaks have occurred in recent years on parts of the San Joaquin No. 3, San Antonio, Bay Division No. 4, and San Andreas Pipelines, and repairs for these pipelines have taken from several days to several months. Seismic safety and flooding issues with Calaveras Dam and Lower Crystal Springs Dam, as described above, have restricted the normal operating capacity of the system. However, the SFPUC has generally been able to continue full water service during these outages and restricted conditions. Nevertheless, the deferred maintenance of major facilities within the system, including critical facilities, has reduced the overall system reliability and capacity over time.

2.3.7 Hetch Hetchy Hydropower Operations

Under the Raker Act of 1913 (discussed in Section 2.4.2, below), the CCSF was required to develop hydroelectric power, since such power was considered a natural byproduct of developing the Hetch Hetchy water supply. The Raker Act requires the CCSF to sell excess Hetch Hetchy power at cost, when available above the city’s own municipal needs, to TID and MID for agricultural pumping and municipal needs. After satisfying its own municipal load and Raker Act obligations to TID and MID, the Raker Act allows the CCSF to sell any remaining Hetch Hetchy power to public agencies for resale and/or directly to end-users. The Raker Act prohibits the CCSF from selling Hetch Hetchy power to private entities for resale.

The major portion of Hetch Hetchy power goes to satisfy San Francisco's own municipal needs, and the balance is sold to TID and MID, industrial customers (such as San Francisco International Airport tenants), and public entities. Municipal agencies (including the CCSF), departments, and enterprises consume slightly more than half of the electricity produced by the Hetch Hetchy power system. Among the city agencies that receive electricity from the SFPUC are the San Francisco Municipal Railway, San Francisco General Hospital, Laguna Honda Hospital, and the SFPUC's regional water, local water, and wastewater facilities. Regional water system facilities that use Hetch Hetchy power include the Sunol Valley WTP and San Antonio Pump Station. These electricity demands are expected to increase over the next decade (SFPUC, 2007b).

The hydropower system, known as the Hetch Hetchy Project, is comprised of 400 megawatts of hydroelectric power generation plants located on the Tuolumne River and 150 miles of high-voltage transmission lines delivering Hetch Hetchy power to the San Francisco Bay Area. Energy production varies by season and by year, depending on hydrologic conditions. The long-term annual average production is approximately 1.7 billion kilowatt-hours. Historical production has ranged from a low of 0.71 billion kilowatt-hours per year to a high of 2.2 billion kilowatt-hours per year (SFPUC, 2002).

There are three major hydropower facilities: the Holm, Kirkwood, and Moccasin Powerhouses. Holm Powerhouse, located on Cherry Creek, generates power from water released from Lake Lloyd/Lake Eleanor; after passing through the hydropower facilities, water is returned to Cherry Creek and ultimately flows in the Tuolumne River into Don Pedro Reservoir. Kirkwood Powerhouse, located along the Tuolumne River below O'Shaughnessy Dam, generates power from water released from Hetch Hetchy Reservoir; after passing through the hydropower facilities, this water is diverted first to Mountain Tunnel and then to the regional water system as part of the Tuolumne River water supply source. Moccasin Powerhouse, located downstream of Priest Reservoir, discharges to Moccasin Reservoir and uses Tuolumne River water to generate power before it flows to the Foothill Tunnel and then to the regional system. Water in excess of that diverted into Mountain Tunnel below Kirkwood Powerhouse and into Foothill Tunnel below Moccasin Powerhouse is released into the Tuolumne River and Moccasin Creek, respectively, and ultimately flows into Don Pedro Reservoir.

The Hetch Hetchy transmission system is comprised of eight transmission lines of varying lengths that interconnect to other power systems and the power grid; the system delivers Hetch Hetchy power to San Francisco's municipal load, TID, MID, several retail customers (including San Francisco International Airport), and to public entity customers. The Hetch Hetchy transmission system connects to MID's system at the Standiford and Warnerville substations, and to TID's system at the Oakdale substation. The Hetch Hetchy transmission system terminates in Newark, where it interconnects to the Pacific Gas and Electric Company (PG&E) power grid; PG&E facilities are used to convey Hetch Hetchy power from Newark to the San Francisco's municipal load and certain retail customers.

As described above, the SFPUC operates its facilities in accordance the Water First Policy. Under this policy, the production of hydropower is considered significant but secondary to water supply and water quality considerations (SFPUC, 2005a). The Water First Policy is also required by Assembly Bill 1823 (Water Code Section 73504[b]) and is further described under Section 2.4, below. For example, both Priest and Moccasin Reservoirs have bypass pipelines that can be put into service when warranted by water quality conditions; use of these pipelines limits peaking power generation, but assures that drinking water quality is preserved and regulatory requirements are met. As discussed in Section 2.5, hydropower operations during certain times of the year are coordinated with releases for whitewater rafting.

2.3.8 Watershed Management

Preservation and protection of watershed lands are an important aspect of SFPUC system operations. By actively managing activities within its watershed boundaries, the SFPUC can protect and maintain the water quality of the source waters for the regional system.

Tuolumne River Watershed

The 459-square-mile portion of the Tuolumne River watershed that flows into Hetch Hetchy Reservoir (Hetch Hetchy watershed) is entirely within Yosemite National Park; approximately 95 percent of this watershed is congressionally designated as wilderness area. This federal designation provides unique measures of protection to the watershed. The National Park Service (NPS) manages Yosemite National Park to preserve the resources that contribute to Yosemite's uniqueness and attractiveness, and to make the varied resources of the park available to people for enjoyment, education, and recreation. The NPS manages the Yosemite wilderness areas to meet the goals and principles of the 1964 Wilderness Act. In wilderness areas, human activities are limited to those that leave no long-term impact on the land or that have little or no effect on the natural resources of the area. People can enter wilderness areas by foot or on horseback, but mechanized access is not allowed.

The SFPUC and NPS negotiated a Watershed Protection Agreement that provides supplemental funding to the NPS to provide extra protection in the watershed (U.S. Department of Interior and SFPUC, 2005). The NPS has many regulations in place to protect water quality in Yosemite. SFPUC funding allows the NPS to employ additional rangers to enforce these regulations. The Watershed Protection Agreement also provides for additional onsite and offsite visitor education and information programs to inform park visitors to the watershed about water quality regulations and wilderness use techniques that protect water quality. Visitors are informed that the watershed is a source of drinking water for the San Francisco Bay Area and of their role in protecting the quality of the drinking water supply. The agreement also provides funding to the NPS so that it can operate and maintain facilities within the watershed to prevent source water contamination.

As part of the requirements for maintaining filtration avoidance (discussed in Section 2.4.1, below), the SFPUC conducts regular inspections of the protected Hetch Hetchy watershed and reservoirs. These inspections are collaborative efforts between the NPS and SFPUC to identify potential sources of drinking water contamination and identify actions to prevent contamination.

Alameda and Peninsula Watersheds

In the Alameda watershed, the CCSF owns about one-third of the lands comprising the southern Alameda Creek drainage area. Portions of the land have been leased for grazing, nursery, and quarry operations, although the watershed lands remain predominantly open space. In the Peninsula watershed, the CCSF owns the majority of the lands draining to the three Peninsula reservoirs (Crystal Springs, San Andreas, and Pilarcitos). In 1969, the CCSF, San Mateo County, and the state and federal governments made easement agreements to preserve the Peninsula watershed for water supply and open space purposes (Hanson, 1994, 2005).

In the 1990s, the SFPUC conducted planning and public outreach for the development of watershed management plans for the Alameda and Peninsula watersheds. Draft plans were published in 1998, followed by environmental review (San Francisco Planning Department, 2000 and 2001). The SFPUC adopted the Alameda and Peninsula Watershed Management Plans (WMPs) in 2000 and 2001, respectively (SFPUC, 2000b, 2001a). The adopted plans provide goals and polices aimed at improving water quality as well as creating a balance between the need for high-quality water and ecological resource protection, and the desire for public access and use of the watershed. The Alameda WMP includes specific elements for grazing and other Sunol Valley resources (including mining, recreation, and creek enhancements), and the Peninsula WMP includes an element for recreational access. Both plans contain specific elements to address fire management.

As part of implementation of the WMPs, the SFPUC is developing habitat conservation plans (HCPs) for both watersheds, in compliance with federal and state regulations for endangered species protection. The objective of these plans is to enable the SFPUC to implement watershed operations and maintenance activities while conserving and enhancing native species, habitats, and ecosystems. The HCPs will provide comprehensive, long-term conservation measures for species listed as threatened or endangered under the Endangered Species Acts or species that could be listed in the future. Other management actions that the SFPUC has implemented include restoration, training, and fire hazard management activities. The HCPs are further described in Chapter 4, Section 4.6, Biological Resources, under Regulatory and Conservation Planning Framework.

2.4 Regulatory Requirements

2.4.1 Safe Drinking Water Act

The basic regulations governing the regional water system are associated with the federal and California Safe Drinking Water Acts. The federal Safe Drinking Water Act, passed in 1974 and amended in 1986 and 1996, is the nation’s primary law regulating drinking water quality and is implemented by the U.S. EPA. The act authorizes the U.S. EPA to set national health-based standards for drinking water and requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells. In addition to source water protection, the act also provides for treatment, monitoring, sampling, analytical methods, reporting, and public information requirements. Implementation and enforcement of both the federal and California Safe Drinking Water Acts are under the jurisdiction of the California Department of Health Services (DHS), Division of Drinking Water and Environmental Management. Drinking water regulations are set forth in the California Code of Regulations, Titles 17 and 22.

The amended federal Safe Drinking Water Act established phases of regulation and a number of regulatory deadlines to address drinking water requirements. This amended act is implemented through subsidiary rules for regulation of specific contaminants or for monitoring or treatment requirements (U.S. EPA, 2007). The major U.S. EPA drinking water regulations are listed below:

- Surface Water Treatment Rule
- Interim Enhanced Surface Water Treatment Rule
- Total Coliform Rule
- Stage 1 Disinfectants and Disinfection Byproducts Rule
- Stage 2 Disinfectants and Disinfection Byproducts Rule
- Long Term 1 Enhanced Surface Water Treatment Rule
- Long Term 2 Enhanced Surface Water Treatment Rule
- Variances and Exemptions Rule
- Lead and Copper Rule
- Radionuclides Rule
- Filter Backwash Recycling Rule
- Arsenic Rule
- Public Notification Rule

Surface Water Treatment Rule and Hetch Hetchy Reservoir

In 1991, the U.S. EPA adopted the Surface Water Treatment Rule, which included water quality provisions for unfiltered systems, referred to as "filtration avoidance." In 1993, the SFPUC applied for the ability to comply with federal filtration avoidance regulations; the DHS reviewed and approved this application, and forwarded its recommendation to the U.S. EPA that the Hetch Hetchy supply be approved as an unfiltered source that meets all criteria in the federal statute for filtration avoidance. The U.S. EPA also approved this application in 1993. In 1998, the state added filtration avoidance provisions to Title 22 of the California Code of Regulations, under which the Hetch Hetchy supply is currently regulated. In 2000, the SFPUC adopted resolution number 00-0277, reaffirming its policy "to maintain the 'filtration avoidance' status for Hetch Hetchy water" and directing its staff "to prepare and submit operating fund and capital project budget requests which are consistent with proactive maintenance of 'filtration avoidance'" (SFPUC, 2000d).

Water from Hetch Hetchy Reservoir can be delivered to SFPUC customers without filtration, provided that it meets the filtration avoidance requirements outlined in the Surface Water Treatment Rule. These requirements include meeting source water quality standards, disinfection criteria, and site-specific criteria. In the Hetch Hetchy system, source water quality standards are measured for compliance at Tesla Portal, where disinfection also occurs. The SFPUC conducts extensive routine water quality monitoring and watershed protection activities and submits a monthly report to the DHS to fulfill filtration avoidance requirements. The report indicates coliform and turbidity levels, compliance with disinfection requirements, compliance with the Total Coliform Rule, quarterly disinfection byproduct levels, operability of disinfection equipment, watershed control activities, and any detected outbreaks of waterborne disease. In addition, the SFPUC submits an Annual Watershed Sanitary Survey Report summarizing compliance with watershed control program requirements, and the SFPUC's comprehensive watershed protection program has been shown to meet specific pathogen barrier criteria. Since 1993, these activities have demonstrated that, without filtration, the water from Hetch Hetchy Reservoir consistently meets or exceeds all water quality standards, indicating a high level of public health protection for regional system customers.

Water from Lake Eleanor, Lake Lloyd, and reservoirs in the Alameda and Peninsula watersheds does not meet filtration avoidance criteria and requires filtration at either the Sunol Valley or Harry Tracy WTPs before it can be delivered to customers.

2.4.2 Raker Act of 1913

In 1913, the federal government passed the Raker Act (Public Law No. 3-41, 38 Stat. 242), which states the following:

> An Act granting to the city and county of San Francisco certain rights of way in, over and through certain public lands, the Yosemite National Park, and Stanislaus National Forest, and certain lands in the Yosemite National Park, the Stanislaus National Forest, and the public lands in the State of California, and for other purposes.
>
> That there is hereby granted to the city and county of San Francisco … all necessary rights of way along such locations for the purpose of constructing, operating, and maintaining aqueducts, canals, ditches, pipes, pipe lines, flumes, tunnels, and conduits for conveying water for domestic purposes and uses to the city and county of San Francisco and such other municipalities and water districts as, with the consent of the city and county of San Francisco, or in accordance with the laws of the State of California in force at the time application is made.

The Raker Act granted to the CCSF rights-of-way and use of public lands in the affected areas to construct, operate, and maintain reservoirs, dams, conduits, and other structures necessary or incidental to developing and using water and power. However, the act imposed many conditions and obligations, stipulating, among others, that the CCSF was required to:

- Recognize the prior rights of TID and MID to receive water the districts could beneficially use, up to specified amounts of the natural daily flow, for direct use and storage
- Construct miles of scenic roads and trails in Yosemite National Park and donate them to the United States
- Started building the dam at Hetch Hetchy and complete it as rapidly as possible

- Enforce specific sanitary regulations within the watershed area
- Develop electric power for municipal and commercial use
- Not divert beyond the limits of the San Joaquin Valley any more of the waters from the Tuolumne watershed than shall be necessary for its beneficial use for domestic or other municipal purposes
- Pay an annual rental starting at $15,000 and rising to $30,000 after 20 years
- Not sell or give Hetch Hetchy water or power to a private person or corporation for resale

The CCSF ratified the Raker Act in the spring of 1914, and the Hetch Hetchy construction program started immediately. Since that time, the CCSF has developed and continues to develop the Hetch Hetchy water and power system and to use Tuolumne River water for municipal, industrial, and hydroelectric power purposes consistent with the provisions of this act.

2.4.3 Assembly Bill 1823

Adopted in 2002, California Assembly Bill 1823, known as the Wholesale Regional Water System Security and Reliability Act, is an act to add and repeal Division 20.5 of the California Water Code, which governs regional water systems. It imposes various requirements on wholesale regional water systems and applies directly to the CCSF and the SFPUC's regional water system. The bill includes numerous stipulations, including the following requirements for the CCSF: to adopt a capital improvement program by February 1, 2003; to adopt an emergency response plan by September 1, 2003; to distribute available water during any interruption to customers on an equitable basis; to continue operating reservoirs in Tuolumne County in a manner that ensures that the generation of hydroelectric power will not cause any reasonably anticipated adverse impact on water service; and to assign higher priority to water delivery to the Bay Area than to hydroelectric power generation.[6]

The act includes the Water First Policy (Water Code Section 73504[b]), which states:

> In order to supply adequately, dependably, and safely the requirements of all users of water, the city shall continue its practice of operating the reservoirs in the Counties of Tuolumne and Stanislaus in a manner that ensures the generation of hydroelectric power will not cause any reasonably anticipated adverse impact on water service. The city shall assign higher priority to delivery of water to the Bay Area than to the generation of electric power, unless the Secretary of the Interior, in writing, notifies the city that doing so would violate the Raker Act (63 Public Law 41).

The act identified specific projects to be included in the program, along with a requirement that a schedule be submitted to the DHS by March 2003 showing that projects representing 50 percent of the costs would be completed on or before 2010, and 100 percent of the projects would be completed on or before 2015. The SFPUC met this requirement and has submitted subsequent

[6] The act allows the SFPUC to add or delete projects from the original capital improvement program, including the list of specific projects that was to be included in the original program.

revisions to the original capital improvement program, which has now been renamed the Water System Improvement Program (SFPUC, 2005b; SFPUC, 2006a).

2.4.4 Dam Safety Program

The California Water Code designates the regulatory Dam Safety Program to the Department of Water Resources, Division of Safety of Dams (DSOD). The principal goal of this program is to avoid dam failure and thus prevent loss of life and destruction of property. The DSOD reviews plans and specifications for the construction of new dams and for the enlargement, alteration, repair, or removal of existing dams, and must grant written approval before the owner can proceed with construction. Professional engineers and geologists from the DSOD evaluate each project, investigate proposed sites, and check available construction materials. Dams under DSOD jurisdiction include artificial barriers (together with appurtenant works) that are 25 feet or more in height or have an impounding capacity of 50 acre-feet or more. Any artificial barrier not in excess of 6 feet in height, regardless of storage capacity, or that has a storage capacity not in excess of 15 acre-feet, regardless of height, is not considered jurisdictional (DSOD, 2007).

In addition to Calaveras and Lower Crystal Springs Dams (which are currently operating under DSOD restrictions), other SFPUC regional system infrastructure under DSOD jurisdiction includes the following: Balboa Reservoir, University Mound Reservoirs (North and South), Sunset Reservoirs (North and South), Stanford Heights Reservoir, Sutro Reservoir, Calaveras Reservoir, Turner Dam, Crystal Springs Reservoir, Pilarcitos Reservoir, San Andreas Reservoir, O'Shaughnessy Dam, Lake Lloyd, Lake Eleanor, Priest Reservoir, Early Intake Reservoir, and Moccasin Reservoir.

2.5 Institutional Considerations

In additional to the regulatory requirements described above, the regional system is subject to a number of institutional agreements and other planning requirements, including those described below.

2.5.1 Existing Water Rights and Entitlements

The CCSF water rights and entitlements for the existing water supply sources of the regional water system have been obtained or granted pursuant to California law. With the exception of San Antonio Reservoir in the Alameda Creek watershed, all water diverted and stored in and through the regional system reservoirs and facilities in the Tuolumne River, Alameda, and Peninsula watersheds is done pursuant to pre-1914 appropriative water rights (see the description of appropriative rights in the following paragraphs). Water is diverted and stored in San Antonio Reservoir pursuant to a license granting an appropriative water right that was issued by the State Water Resources Control Board (SWRCB) in 1959.

Description of California Water Rights

California recognizes both appropriative and riparian water rights. An appropriative water right allows the holder to divert from a water source to a place of use not connected to the water source. The appropriative water right is based on a place of use, a purpose of use, and a method of diversion. Riparian rights holders, on the other hand, only have the right to divert from a water source to adjacent land for use on such land. Appropriative rights are based on seniority—that is, first in time, first in right—with those having the most senior water rights enjoying the most security in the use of water. In times of shortage, junior water-rights holders must cease diversions until all water rights that are senior to them have been satisfied. Use of water under an appropriative water right must be reasonable, beneficial, and not wasteful.

Originally, physical diversion was evidence of the right of use in California, but in 1872 California formally enacted Civil Code provisions (Civil Code Sections 1410–1422) recognizing appropriative water rights. After 1872, an appropriator simply had to post a notice of water right in a conspicuous place at the proposed point of diversion and then record the notice with the county recorder. Water rights noticed under the Civil Code were perfected through diligence in the construction of water diversion works that put the water to the beneficial uses in the places identified in the notice. If the appropriator followed the provisions of the Civil Code within the prescribed timeframes, the appropriator obtained a priority date as of the posting date of the notice, even though completion of the appropriation was substantially later. In recognition of the special needs of municipalities to make the best use of limited funds and to increase use as population grows, California law allows municipalities that hold pre-1914 water rights to increase the use of their water rights over time as the need for water increases (Civil Code Section 1416).

In 1914 California established a formal water rights permit system to create a more orderly method of appropriating unappropriated waters. The State Water Resources Control Board (SWRCB) now administers the water-rights permit system. While the SWRCB has sole authority to issue new appropriative water rights, it does not have authority to define the property rights created under a pre-1914 appropriative water right. The courts are charged with defining the validity and scope of water rights of pre-1914 appropriators when the extent of such rights or claims is in dispute.

San Francisco’s Water Rights

The CCSF has sufficient pre-1914 and post-1914 water rights for existing operations and facilities as well as proposed operations and facilities under the WSIP. This is true for both the Hetch Hetchy and local portions of the regional water system, including the proposed Calaveras Dam Replacement project and the proposed Lower Crystal Springs Dam Improvement project (described in Chapter 3), neither of which would expand the capacity of these reservoirs beyond historical levels under CCSF water rights.

As to the Tuolumne River supply, the CCSF made numerous water-rights filings on the Tuolumne River between 1901 and 1911. The Tuolumne River water-rights filings support a *prima facie* diversion rate well over 400 mgd. The 1912 Freeman Report, which provided the basis for the CCSF's proposals to Congress to develop the Hetch Hetchy Project, identified 400 mgd as the ultimate diversion from the Tuolumne River.

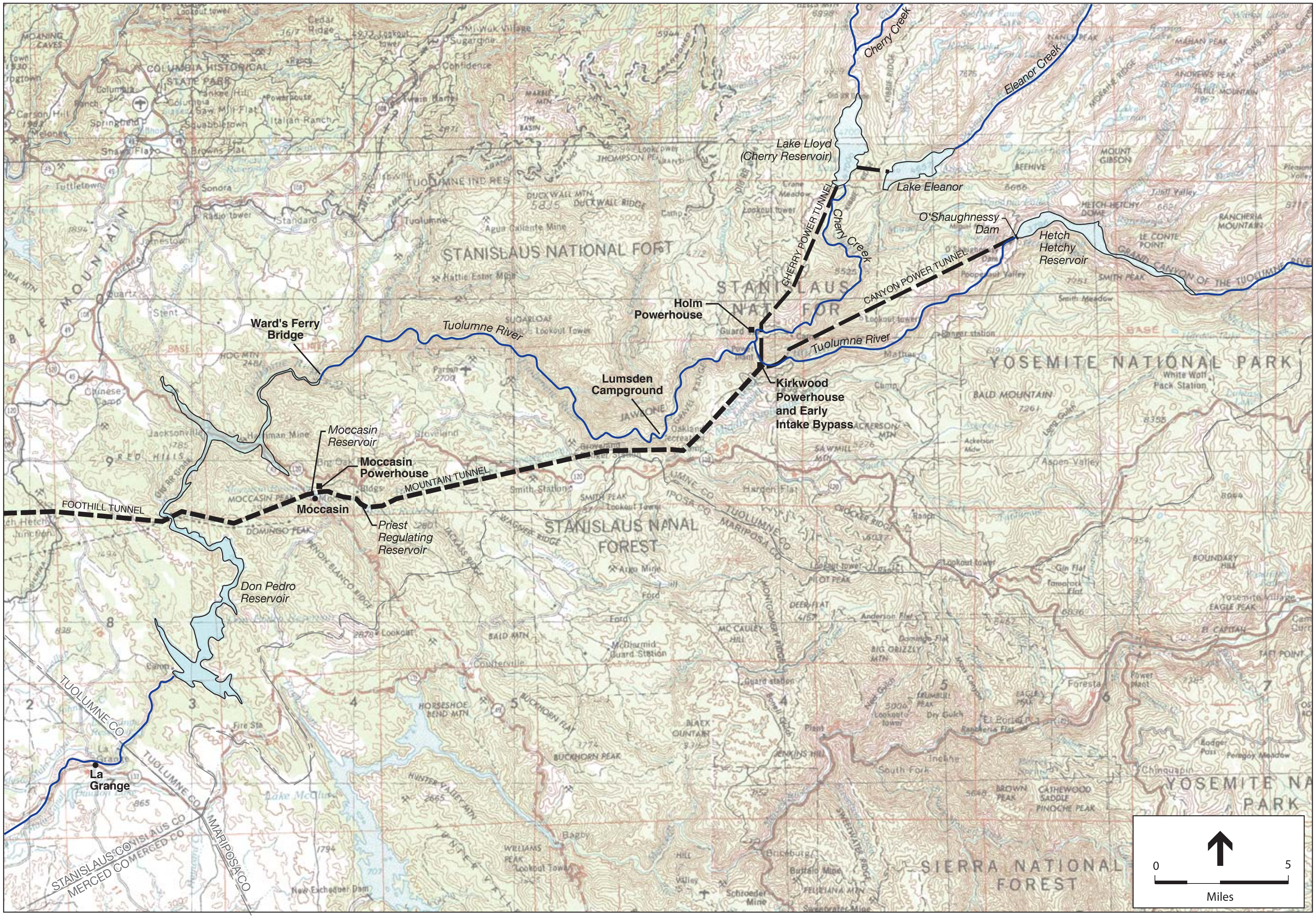
The operation of the SFPUC water supply system is a matter of historical record. Since the third San Joaquin Pipeline was put into service in 1968, the historical annual diversions to the Bay Area from the Tuolumne River through the San Joaquin Pipelines (Tuolumne River diversions) have varied widely, depending on the time of year and year type. Since 1968, Tuolumne River diversions have averaged about 197 mgd (fiscal year [FY] 1968/2004), with a maximum annual diversion of 295 mgd (FY 1987/1988). The average diversion of 197 mgd is about 12 percent of the total average natural flow of the Tuolumne River at La Grange Dam. For that same period, FY 1968/2004, annual deliveries to SFPUC customers averaged about 248 mgd, with an annual average maximum purchase of 293 mgd (FY 1987/1988). Monthly Tuolumne River diversions have been as high as 305 mgd (January 1977), with daily sustained diversions as high as 310 mgd (August 1984).

As noted above, the Raker Act requires San Francisco to recognize the senior water rights of TID and MID to divert water from the Tuolumne River. Specifically, the Raker Act requires the CCSF to bypass certain flows through its Tuolumne River reservoirs to TID and MID for beneficial use. By agreement, the CCSF, TID, and MID, have supplemented these Raker Act obligations to increase the TID and MID entitlements to account for other senior Tuolumne River water rights and to allow the CCSF to "pre-pay" TID and MID their entitlement by storing water in the Don Pedro water bank (see the Don Pedro water bank discussion below). The CCSF is required to bypass inflow to TID and MID sufficient to allow them to divert 2,416 cfs or natural daily flow, whichever is less, at all times (as measured at La Grange), except for April 15 to June 13, when the requirement is 4,066 cfs or natural daily flow as measured at La Grange, whichever is less.

2.5.2 New Don Pedro Project

In 1964, the Federal Energy Regulatory Commission (FERC) issued a license to TID and MID to construct the New Don Pedro Dam and Reservoir on the lower Tuolumne River, about 50 miles downstream from O'Shaughnessy Dam and Hetch Hetchy Reservoir, as shown in **Figure 2.7**. Construction of the New Don Pedro Reservoir (referred to hereafter in this PEIR as Don Pedro Reservoir) was completed and operation began in 1971; it has a gross capacity of 2,030,000 acre-feet and a net usable capacity for irrigation, flood control, and hydropower generation of 1,721,000 acre-feet (FERC, 1996a).

As part of the development of the New Don Pedro Project, the CCSF, TID, and MID entered into agreements to specify the rights and entitlements of each party and their respective responsibilities for the New Don Pedro Project (CCSF/TID/MID, 1966). One of the agreements allocates storage space in Don Pedro Reservoir for a specified volume of water within the CCSF entitlement. This storage space is referred to as the "water bank account" and provides the SFPUC flexibility in the operation of Hetch Hetchy Reservoir. The water bank account allows the CCSF to meet the entitlements and prior rights of TID and MID under the Raker Act and subsequent agreement, while maximizing the use of water from Hetch Hetchy Reservoir to supply



SOURCE: ESA + Orion; SFPUC, 2006; USGS 1970

SFPUC Water System Improvement Program . 203287

Figure 2.7
Tuolumne River Features Below Hetch Hetchy Reservoir

water to SFPUC customers. As described above, TID and MID have senior water rights to the CCSF for Tuolumne River water and are entitled to the first increment of flow in the basin.

San Francisco's allocation of storage space in Don Pedro Reservoir varies from 570,000 to 740,000 acre-feet, depending on whether flood control restrictions on the reservoir are in effect. Basically, the SFPUC adds water to its water bank account whenever the inflow to Don Pedro Reservoir exceeds the TID and MID entitlements; conversely, the SFPUC debits from the water bank account whenever it diverts or stores Tuolumne River water that would otherwise be within the entitlements of TID and MID.

As described in Section 2.2.1, water from Lake Eleanor and Lake Lloyd that is used to produce hydroelectric power and provide flows for recreational and fishery (i.e., nonconsumptive) uses is returned to Cherry Creek and the Tuolumne River and ultimately flows downstream to Don Pedro Reservoir. The releases from Lake Eleanor and Lake Lloyd can be used to meet the TID and MID entitlements. When in excess of TID and MID entitlements, these flows to Don Pedro Reservoir can be credited to the SFPUC water bank account, thus allowing the SFPUC more flexibility during different times of the year to deliver water from Hetch Hetchy Reservoir to its customers.

2.5.3 Instream Flow Releases

Hetch Hetchy Facilities

The Raker Act gave the CCSF the right to develop a municipal water and power system subject to conditions and regulations of the Department of the Interior (DOI) and the Department of Agriculture (DOA) for the protection of public lands. In exercising their authority, the DOI and DOA have imposed conditions on the CCSF's rights-of-way to conform with federal policies, and, in the 1950s, the DOI and DOA began requiring water releases from Hetch Hetchy facilities to maintain minimum stream flows to benefit instream fisheries and other wildlife[7] (CCSF, 1961).

Lake Lloyd (Cherry Reservoir)

In 1949, the CCSF filed an amended application to change the boundaries for rights-of-way for the then-proposed Cherry Reservoir. The CCSF entered into stipulations with the DOA, which were executed on February 28, 1950, to release specified flows from Cherry Reservoir (now known as Lake Lloyd) "for the protection and maintenance of fish, wildlife and recreation in the Cherry River below the Dam." The Cherry stipulations require the CCSF to release 5 cfs from October 1 through June 30, and 15 cfs from July 1 through September 30 (CCSF, 1956).

7 Hetch Hetchy Project facilities, with the exception of the Moccasin low-head hydroelectric facility, are exempt from FERC jurisdiction for the licensing of hydroelectric facilities. Most hydropower facilities in the United States are regulated by FERC, and many are required by FERC to make releases for instream fisheries.

Lake Eleanor

In the mid-1950s, the CCSF applied for permission from the DOI to relocate tunnel aqueducts, steel penstock, and the power plant site of the Cherry River Project. In granting the changes in rights-of-way, the DOI conditioned its approval on the CCSF agreeing to instream releases into Eleanor Creek to support fisheries. These flows were increased in 1982 when the CCSF sought changes in rights-of-way to build the Cherry-Eleanor Pump Station. The fishery releases were based on an evaluation performed by the U.S. Forest Service fisheries biologist, and evaluations and recommendations made by the U.S. Fish and Wildlife Service (USFWS) and the CDFG. The Eleanor stipulations require the CCSF to release 5 cfs from October 1 through June 30, and 15.5 cfs from July 1 through September 30 in years when no pumping occurs between Lake Lloyd and Lake Eleanor. In years when pumping occurs, the Eleanor stipulations require the CCSF to release 5 cfs from November 1 through February 28, 10 cfs from March 1 through April 14, 20 cfs from April 15 through September 15, and 10 cfs from September 16 through October 31 (CCSF, 1982).

Hetch Hetchy Reservoir

There were no instream flow requirements when O'Shaughnessy Dam was originally constructed. However, when the Canyon Power Project and Kirkwood Powerhouse were proposed in the 1950s, it became necessary to modify right-of-way conditions specified in the Raker Act, which led to a series of conditions for fishery releases from Hetch Hetchy Reservoir. In 1958, the CCSF agreed to make interim releases from Hetch Hetchy Reservoir until the NPS, U.S. Forest Service, and USFWS completed a fishery study. The study was completed in August 1976, but the CCSF contested the study. In 1984, the CCSF, federal agencies, and interested parties reached an agreement for fishery releases, which was approved by the DOI in 1985. The 1985 stipulations established three different minimum flow release schedules based on hydrologic year type. Shortly thereafter, the CCSF began building a third generating unit at Kirkwood Powerhouse, and the DOI determined that additional conditions for fishery releases were required. These stipulations, which were signed in 1987, modified and increased the flow schedules. This last set of stipulated fishery release schedules—based on the 1976 fish study and continued discussions and negotiations between federal agencies, the CCSF, and other interested parties—currently dictates the CCSF instream flow releases at O'Shaughnessy Dam (CCSF, 1987).

The Hetch Hetchy stipulations set forth basic flow schedules and amounts for discretionary releases. The flow schedules, defined for three hydrologic year types, are triggered by the amount of cumulative precipitation and runoff at Hetch Hetchy Reservoir over a specified period of time. The schedule for a given month is determined on the first day of the month. From January through June, a schedule for a given month is determined by the cumulative precipitation in the Hetch Hetchy watershed since October 1 of the preceding year. During July and August, the cumulative runoff into Hetch Hetchy Reservoir since October 1 of the preceding year determines which schedule will be used. The schedule for the balance of the year after August is the schedule in effect on August 1. The minimum amount of water to be released annually is 59,235 acre-feet for Schedule A, 50,019 acre-feet for Schedule B, and 35,215 acre-feet for Schedule C. The SFPUC must release an additional 64 cfs into the river below Hetch Hetchy Reservoir when the diversion through Canyon Tunnel exceeds 920 cfs. Finally, the stipulations provide for an additional supplemental release depending on water-year type, subject to completion of a habitat study and a corresponding determination of the timing of such releases. Chapter 5 of this PEIR presents more information on the triggers and the minimum release schedules for Hetch Hetchy Reservoir (CCSF, 1987).

Moccasin Fish Hatchery

The SFPUC releases water for the Moccasin Fish Hatchery under a 20-year lease agreement (1992–2012) between the CCSF and the State of California. Under the lease, the state has the right to take up to 30 cfs from Moccasin Reservoir for hatchery needs. After use in the hatchery, the water is released into Moccasin Creek, where it flows into Don Pedro Reservoir (CCSF, 1992).

Peninsula and Alameda Watershed Facilities

There are currently no release agreements to support fisheries in the regional system reservoirs or dams on the Peninsula, which includes Pilarcitos, Stone, San Andreas, and Crystal Springs Dams and Reservoirs. However, as described above, the SFPUC is currently making experimental releases from Stone Dam to support ongoing studies of aquatic resources in Pilarcitos Creek below Stone Dam. The SFPUC intends to develop a final release schedule from Stone Dam in coordination with the state and federal regulatory agencies as part of the Peninsula HCP.

In the Alameda watershed, Calaveras Dam and Reservoir is the only facility operating under an agreement to make releases in support of fisheries.[8] In 1997, the SFPUC and CDFG entered into an MOU regarding the magnitude and timing of flows to be released from Calaveras Reservoir for the improvement of habitat conditions for fisheries on Alameda and Calaveras Creeks (CDFG, 1997). The MOU specifies that the maximum quantity of water the SFPUC may be required to release will not exceed 6,300 acre-feet per year, and that the SFPUC will conform with flow schedules for water releases, varying between 7 cfs during late spring and summer and up to 20 cfs during the two-month winter trout-spawning period. The MOU also states that a suitable point exists for the recapture of water released, and a recapture facility may be constructed in the vicinity of the Sunol Valley WTP so that the SFPUC can recapture this water for consumptive use in the SFPUC service area. The recapture project is one of the WSIP facility improvement projects evaluated in this PEIR.

In addition, in October 1991 the SFPUC issued an MOU with the CDFG regarding the Calaveras Reservoir intake screen design and operating procedures (SFPUC, 1991). The agreement specifies that "Calaveras Reservoir will be operated to minimize the potential hazard to juvenile fish populations by recognition of critical season periods, operating levels and screen approach velocities." In effect, the agreement restricts Calaveras Reservoir from being operated at an elevation greater than 690 feet (CDM, 2005).

[8] The other SFPUC dams in the Alameda watershed include Turner Dam (on San Antonio Reservoir). The Sunol and Niles Dams—two inactive dams on Alameda Creek below San Antonio Reservoir in Niles Canyon—were removed in the fall of 2006 to help restore fish passage.

As previously described in Section 2.3.4, the SFPUC recently installed a low-flow valve at Calaveras Dam to allow for future lower volume releases.

Other Tuolumne River Fishery Release Requirements

As described above, TID and MID own and operate the New Don Pedro Project and make fishery releases below Don Pedro Reservoir at La Grange Dam consistent with a FERC license. In general, TID and MID are required to conform releases to one of seven basic flow schedules based on hydrologic year type. The total volume of release ranges from 94,000 acre-feet to 300,923 acre-feet, depending on the wetness of the San Joaquin River basin, with a summer flow ranging from 50 cfs to 250 cfs. Annual minimum flow schedules vary by three periods, defined as October 1 to October 15, October 16 to May 31, and June 1 to September 30, with additional fall and spring pulse flows for salmon adult attraction and smolt out-migration, respectively (FERC, 1996a).

In conjunction with the 1966 FERC license to TID and MID for the New Don Pedro Project, the CCSF, TID, and MID executed the Fourth Agreement to finance construction and establish operations for the project (CCSF/TID/MID, 1966). The three parties agreed to allocate the potential water supply risk that might result from a change in the interim flow schedules as follows:

> The Districts [TID and MID] and City [CCSF] recognize that Districts, as licensees under the [FERC] license for the New Don Pedro project, have certain responsibilities regarding the water release conditions contained in said license, and that such responsibilities may be changed pursuant to further proceedings before the [FERC]. As to these responsibilities, as they exist under the terms of the proposed license or as they may be changed pursuant to further proceedings before the [FERC], Districts and City agree:
>
>> … (b) That at any time Districts demonstrate that their water entitlements, as they are presently recognized by the parties, are being adversely affected by making water releases that are made to comply with [FERC] license requirements, and that the [FERC] has not relieved them of such burdens, City and Districts agree that there will be a re-allocation of storage credits so as to apportion such burdens on the following basis: 51.7121% to City and 48.2879% to Districts. (CCSF/TID/MID, 1966)

In 1994, FERC initiated mediation among 12 parties, including the CCSF, TID, and MID, on flow schedules and other matters related to releases in support of fisheries in the lower Tuolumne River. In February 1996, TID and MID filed with FERC an uncontested settlement agreement that included minimum flow schedules that are greater than the previous flow schedules. In July 1996, FERC amended the New Don Pedro Project license to incorporate the settlement agreement flow schedules (FERC, 1996b).

The CCSF, TID, and MID entered into a settlement agreement regarding the FERC flow schedules. Under this agreement, the CCSF makes annual payments to TID and MID, and TID and MID meet all flow requirements of the minimum flow schedules. The 1996 settlement agreement extends through the remainder of the FERC license (i.e., 2016) and any annual licenses. FERC may modify the fishery release requirements for the New Don Pedro Project in 2016 when TID and MID apply for a new license for hydroelectric operations (CCSF/TID/MID, 1995).

2.5.4 Rafting Flows

There are two whitewater runs in the Tuolumne River watershed above Don Pedro Reservoir: an 18-mile run on the Main Fork from Lumsden Campground to Ward's Ferry Bridge, known as the Lumsden Run, and a 9-mile run that begins at Holm Powerhouse on Cherry Creek and ends at Lumsden Campground, known as the Cherry Creek Run (refer to Chapter 5, Figure 5.3.8-1). Commercial companies operate under special-use permits issued by the U.S. Forest Service, Stanislaus National Forest. Private whitewater boaters must obtain permits from the Forest Service to boat the Tuolumne River between April 1 and September 30. Over the last 10 years, an average of 6,000 people per year participated in whitewater rafting on the river (see Chapter 5, Section 5.3.8, for more description of whitewater recreational use).

The flow schedules for Hetch Hetchy projects were intended to benefit fish and recreational fishing, not whitewater recreation. Neither the Raker Act nor the existing stipulations require the CCSF to make instream flow releases to maintain or enhance whitewater recreation. However, as described above, the 1996 FERC Settlement Agreement for the New Don Pedro Project requires the CCSF to consult, cooperate, and communicate with whitewater recreational interests with respect to SFPUC flow releases.

Subject to the availability of water and the CCSF's need for energy, the SFPUC attempts to accommodate whitewater recreation in the Tuolumne River by adjusting the day and hour of releases (i.e., "shaping" releases) from Holm Powerhouse to meet the needs of whitewater rafters. For rafting flows, the SFPUC attempts to meet up to 1,100 cfs on the Tuolumne River at Lumsden Campground. SFPUC staff meets annually with stakeholders representing the whitewater recreational community to develop, to the degree practicable, schedules of releases for whitewater recreation.

2.5.5 Customer Agreements – Master Water Sales Contracts

The SFPUC currently holds individual agreements with its wholesale customers, who are represented by the Bay Area Water Supply and Conservation Agency (BAWSCA) (formerly the Bay Area Water Users Association, or BAWUA). A list of the current BAWSCA members is provided in Chapter 3, Table 3.1, and their locations are shown on Figure 3.2. Wholesale water rates are set in accordance with the 1984 Settlement Agreement and Master Sales Water Contract (Master Water Sales Agreement) between the CCSF and each of the wholesale customers (CCSF, 1984). The current master contract expires in June 2009.

In addition to providing terms for the rate schedule and allocation of operating and capital costs, the Master Water Sales Agreement also addresses water supply and use of local water. Under the Master Water Sales Agreement, the CCSF has agreed that the wholesale customers may collectively purchase up to 184 mgd on an average annual basis through June 2009 subject to reductions in the event of a drought, water shortage, earthquake, other natural disaster, or rehabilitation and maintenance of the system; this amount is referred to as “the supply assurance.” The supply assurance remains effective following termination of the Master Water Sales Agreement and includes the corresponding individual contracts with the wholesale customers. The Master Water Sales Agreement requires that wholesale customers employ best efforts to use all sources of water owned or controlled by them, including groundwater (SFPUC and BAWUA, 2000).

Terms of the individual agreements vary among the wholesale customers. The City of Hayward and Estero Municipal Improvement District have “all requirements” agreements; that is, the SFPUC has agreed to meet all of these two customers’ water needs in excess of other water sources owned or controlled by them. The SFPUC’s agreement with the Estero Municipal Improvement District terminates in 2011, while the agreement with the City of Hayward has no termination date. These agreements imply that as Hayward and Estero’s water usage grows, the residual water of the supply assurance is shared among the other wholesale customers. Under the Master Water Sales Agreement, the SFPUC also sells water to the Cities of San Jose and Santa Clara on a temporary, interruptible basis.

The Master Water Sales Agreement does not address the issues of whether the CCSF is obligated under federal or state law to (1) supply the wholesale customers with water beyond the supply assurance of 184 mgd, or (2) expand the regional water system in order to provide additional water. However, the SFPUC works cooperatively with the BAWSCA and the individual wholesale customers to provide reliable, high quality and affordable water to meet customers’ needs.

2.5.6 SFPUC Water Resources Policies

The SFPUC has adopted numerous resolutions related to water resources, including policies fundamental in the development of the WSIP. These resolutions and policies were used as the basis of many of the program objectives for the WSIP, including policies related to protecting and maintaining the Tuolumne River water supply source; maximizing the use of conservation, recycled water, and groundwater; augmenting dry-year water supplies; coordinating water supply planning efforts with wholesale customers; protecting the environment; and filtration avoidance for Hetch Hetchy water. These resolutions are summarized in **Table 2.3**.

TABLE 2.3
SFPUC WATER RESOURCES POLICIES RELATED TO THE WSIP

Date	Resolution Number	Description
March 1993	93-0083 to 93-0088	This series of six resolutions addresses a water resource policy aimed at preserving and enhancing San Francisco's high-quality water supply and preparing for future water needs by pursuing the beneficial use of alternate resources.
	93-0083	The SFPUC directs staff and management to work with city leaders to develop funding and to provide necessary staffing and programs to accomplish the goals and objectives of this policy statement.
	93-0084	*Defense of Water Rights.* Due to the extraordinarily high quality of the Sierra water supply and the high degree of watershed protection it receives, it is important that San Francisco's share of the waters of the Tuolumne River be preserved for the beneficial municipal and industrial use of San Francisco and its customers. The SFPUC does and will continue to vigorously protect its Sierra water rights, facilities, and method of diversion against all challenges.
	93-0085	*Conservation, Recycled Water, and Groundwater.* Conservation, recycled water, and groundwater usage will extend the time before which maximum diversions from the Hetch Hetchy system will be required, may offset some required deliveries from the Hetch Hetchy system, and will provide greater reliability of supply during times of water shortage. It is the policy of the SFPUC to maximize the use of conservation, recycled water, and groundwater to the extent economically, technically, and environmentally reasonable to do so.
	93-0086	*Dry-Year Options and Supply Augmentation.* Because of San Francisco's junior rights to the waters of the Tuolumne River and the entitlement structure embodied in the Raker Act, San Francisco's Sierra supplies are vulnerable to prolonged periods of drought. There is growing interest and opportunity within the California water community in making water transfers on a long-term, planned basis. The SFPUC directs staff to pursue contractual arrangements that will augment its Sierra supplies. Priority will be given to transfers or exchanges that increase Tuolumne River supplies available to San Francisco, or conservation projects within the Tuolumne River basin that increase supplies available to San Francisco.
	93-0087	*Bay Area Water Supply Planning.* San Francisco supplies water to itself and 33 suburban customers in the Bay Area. Some of the suburban customers have access to other supplies such as the State Water Project, Santa Clara Valley Water District, groundwater, and local surface supplies. It is not possible to plan for the needs of San Francisco's suburban customers for water supplied from San Francisco's system without also projecting the availability of their alternate water sources. The SFPUC directs staff to engage with its suburban customers, the Santa Clara Valley Water District, and other interconnected suppliers in a comprehensive and coordinated water supply planning effort.
	93-0088	*Environmental Improvements.* The SFPUC, Mayor, Board of Supervisors, and the people of San Francisco share a concern for the protection of the environment. The SFPUC directs staff to seek opportunities to contribute to the improvement of the state's aquatic environment through design and operation of its conservation, recycled water, or groundwater projects; water purchase, transfer, and exchange agreements; and future water supply development. Further, the SFPUC will not object to a statewide financial assessment on the use of water so long as it is equitable and the funds are used to purchase water for environmental uses.

TABLE 2.3 (Continued)
SFPUC WATER RESOURCES POLICIES RELATED TO THE WSIP

Date	Resolution Number	Description
April 2000	00-0110	*Water Resource Policies* • To encourage the wise use of all water resources by the City of San Francisco and SFPUC suburban customers, including conservation, water recycling, and groundwater development • To fairly allocate water shortages among the City of San Francisco and SFPUC suburban customers • To fully recover the costs of capital improvements and water purchases • To fairly share the costs of financing capital improvements as they are implemented among the City of San Francisco and SFPUC suburban customers • To aggressively preserve and protect SFPUC water rights to the Tuolumne River supply • To retain full and absolute control of SFPUC water supplies, lands, and capital assets
September 2000	00-0277	*Filtration Avoidance* • The SFPUC reaffirms its policy to maintain the filtration avoidance status for Hetch Hetchy water. • The SFPUC directs staff to prepare and submit Operating Fund and capital project budget requests that are consistent with proactive maintenance of filtration avoidance.
June 2006	06-0105	*Water Enterprise Environmental Stewardship Policy* The Environmental Stewardship Policy will be integrated into SFPUC Water Enterprise planning and decision-making processes and also directly implemented through a number of efforts, including: • Implementation and updating of the existing Alameda and Peninsula Watershed Management Plans • Development of Habitat Conservation Plans for the Alameda and Peninsula Watersheds • Development and implementation of the Watershed and Environmental Improvement Program, which will cover the Tuolumne River, Alameda Creek, and Peninsula watersheds • Development of the Lake Merced Watershed Plan • Active participation in local forums, including coordination with Yosemite National Park Service and Stanislaus National Forest in the Tuolumne River watershed, the Tuolumne River Technical Advisory Committee, the Alameda Creek Fisheries Restoration Workgroup, the Pilarcitos Creek Restoration Workgroup, and the Lake Merced Task Force • Integration of the policy into the WSIP and individual infrastructure projects (i.e., repair and replacement programs) • Reliance on the policy to guide the development of project descriptions, alternatives and mitigation for all SFPUC projects during the environmental review process under CEQA and/or NEPA • Providing support for and encouragement to all employees to integrate environmental stewardship into daily operations through communication and training

SOURCES: SFPUC, 1993a to 1993f; 2000c; 2000d; 2006b.

2.6 References – Existing Regional Water System

California Department of Fish and Game (CDFG), Memorandum of Understanding between the City and County of San Francisco Public Utilities Commission and the California Department of Fish and Game regarding Water Release and Recapture Facilities for Purposes of Improving Native Fisheries on Alameda and Calaveras Creeks. July 25, 1997.

California Division of Safety of Dams (DSOD), Letter from Stephen W. Verigin, Chief, Division of Safety of Dams, to Patricia E. Martel, General Manager, San Francisco Public Utilities Commission, regarding Calaveras Dam, No. 10, Alameda County, February 20, 2003.

California Division of Safety of Dams (DSOD), official website, http://damsafety.water.ca.gov/, accessed May 15, 2007.

CDM, *Regional Water System Operations Plan, San Francisco Public Utilities Commission*, April, 2005.

City and County of San Francisco (CCSF), Stipulations and Amendments of Rights-of-Way for Cherry River Power Project. Filed July 30, 1920 in U.S. Land Office at Sacramento, California, April 24, 1956.

City and County of San Francisco (CCSF), Stipulations for Relocation and Amendment of Rights-of-Way for Tunnel Aqueduct, Steel Penstock, Power Plant Site, Spoil Areas and Access Roads as Approved Pursuant to Maps Filed April 10, 1914, July 13, 1916, and December 13, 1916 in U.S. Land Office at Sacramento, California. May 3, 1961.

City and County of San Francisco (CCSF), Stipulations for Change of Location of Right of Way, for Power Line to Proposed Cherry-Eleanor Pumping Station Pursuant to Map C-5393. Filed February 2, 1981 in U.S. Land Office at Sacramento, California. January 1, 1982.

City and County of San Francisco (CCSF) et al., Settlement Agreement and Master Water Sales Contract between the City and County of San Francisco and Certain Suburban Purchasers in San Mateo County, Santa Clara County and Alameda County. May 25, 1984.

City and County of San Francisco (CCSF), Modification for Kirkwood Powerhouse Unit No. 3 to Stipulation for Amendment of Rights of Way for Canyon Power Project Approved by Secretary of the Interior on May 26, 1961 to Fulfill the Conditions Set Forth in Provision 6 of Said Amendment. March 10, 1987.

City and County of San Francisco (CCSF), Resolution 92-0208: Moccasin Creek Lease Second Renewal. July 14, 1992.

City and County of San Francisco, Turlock Irrigation District, and Modesto Irrigation District (CCSF/TID/MID), Fourth Agreement between the City and County of San Francisco and the Turlock Irrigation District and the Modesto Irrigation District. June 1966.

City and County of San Francisco, Turlock Irrigation District, and Modesto Irrigation District (CCSF/TID/MID), Water Supply Agreement between the City and County of San Francisco and the Modesto and Turlock Irrigation Districts. Executed April 21, 1995.

Federal Energy Regulatory Commission (FERC), *Reservoir Release Requirements for Fish at the New Don Pedro Project, California*, FERC Project No. 2299-024. Final Environmental Impact Statement. July 1996a.

Federal Energy Regulatory Commission (FERC), Order Amending License and Dismissing Rehearing Requests (FERC Order issued re: Turlock Irrigation District and Modesto Irrigation District), July 31, 1996b.

Hanson, Warren D., *San Francisco Water and Power. A History of the Municipal Water Department and Hetch Hetchy System*, 1994, and subsequent edition, 2005.

Moran, Anson B., Affidavit of Anson B. Moran, Project No. 2299. Federal Energy Regulatory Commission, Turlock Irrigation District and Modesto Irrigation District. January 26, 1994.

Olivia Chen Consultants, *Report on the Seismic Stability of Calaveras Dam*, Alameda County, California, 2003.

Olivia Chen Consultants and San Francisco Public Utilities Commission, Water Supply, Transmission and Distribution System Schematic Diagram, Hetch Hetchy Water and Power Division and Water Supply and Treatment Division, June 21, 2005.

San Francisco Planning Department, *Alameda Watershed Management Plan, Final Environmental Impact Report*, August 2000.

San Francisco Planning Department, *Peninsula Watershed Management Plan, Final Environmental Impact Report*, 2001.

San Francisco Public Utilities Commission (SFPUC), Memorandum from Norman H. Lougee, Water Supply Engineer, San Francisco Water Department to California Department of Fish and Game, Larry E. Week, dated October 11, 1991, regarding Department of Fish and Game/San Francisco Water Department Memorandum of Understanding, Calaveras Reservoir Intake Screen Design/Operating Procedures, 1991.

San Francisco Public Utilities Commission (SFPUC), Response to Data Request Concerning FERC Opinion 420, New Don Pedro Project FERC Project 2299. Hetch Hetchy Water and Power Department, June 8, 1993.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0083, March 23, 1993a.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0084, March 23, 1993b.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0085, March 23, 1993c.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0086, March 23, 1993d.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0087, March 23, 1993e.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 93-0088, March 23, 1993f.

San Francisco Public Utilities Commission (SFPUC), *Interim Water Shortage Allocation Plan*, 2000a.

San Francisco Public Utilities Commission (SFPUC), *Alameda Watershed Management Plan*, 2000b.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 00-0110, April 25, 2000c.

San Francisco Public Utilities Commission (SFPUC), Resolution No. 00-0277, December 12, 2000d.

San Francisco Public Utilities Commission (SFPUC), *Peninsula Watershed Management Plan*, 2001a.

San Francisco Public Utilities Commission (SFPUC), *Retail Water Shortage Allocation Plan*, December 11, 2001b.

San Francisco Public Utilities Commission (SFPUC), *Long Term Strategic Plan for Capital Improvements,* May 2002.

San Francisco Public Utilities Commission (SFPUC), Regional Water System Facility Data Sheets. Transmission System Training. Water Supply and Treatment Division, Policies and Procedures Training Program, September 29, 2004.

San Francisco Public Utilities Commission (SFPUC), Water System Improvement Program prepared for the Programmatic Environmental Impact Report, February 28, 2005a.

San Francisco Public Utilities Commission (SFPUC), Regional Water System Improvement Program 2005, Responses to Assembly Bill 1823 Legislation, March 25, 2005b.

San Francisco Public Utilities Commission (SFPUC), Assembly Bill 1823, Notice of Changes to Water System Improvement Program, January 2006a.

San Francisco Public Utilities Commission (SFPUC), Water Enterprise Environmental Stewardship Policy, June 27, 2006b.

San Francisco Public Utilities Commission (SFPUC), *Water Supply Options*, June 2007a.

San Francisco Public Utilities Commission (SFPUC), Official Website, About Us: Power. (http://sfwater.org/mc_main.cfm/MC_ID/12) accessed on June 14, 2007b.

San Francisco Public Utilities Commission (SFPUC) and Bay Area Water Users Association (BAWUA), *Water Supply Master Plan*, April 2000.

URS, *Regional Water System Hetch Hetchy Water and Power System Operations Plan. Final Report*, August 2006.

U.S. Department of the Interior, Yosemite National Park, and SFPUC, *Hetch Hetchy Watershed Protection Agreement*, 2005.

U.S. Environmental Protection Agency (U.S. EPA), Safe Drinking Water Act. Website (http://www.epa.gov/safewater/regs.html) accessed on June 14, 2007.