5.4 Alameda Creek Watershed Streams and Reservoirs

5.4 Alameda Creek Watershed Streams and Reservoirs

Section 5.4 Subsections

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5.4.1 Stream Flow and Reservoir Water Levels

The following setting section describes the streams and reservoirs in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.1.2) provides a description of the changes in stream flow and reservoir water levels that would result from implementation of the WSIP.

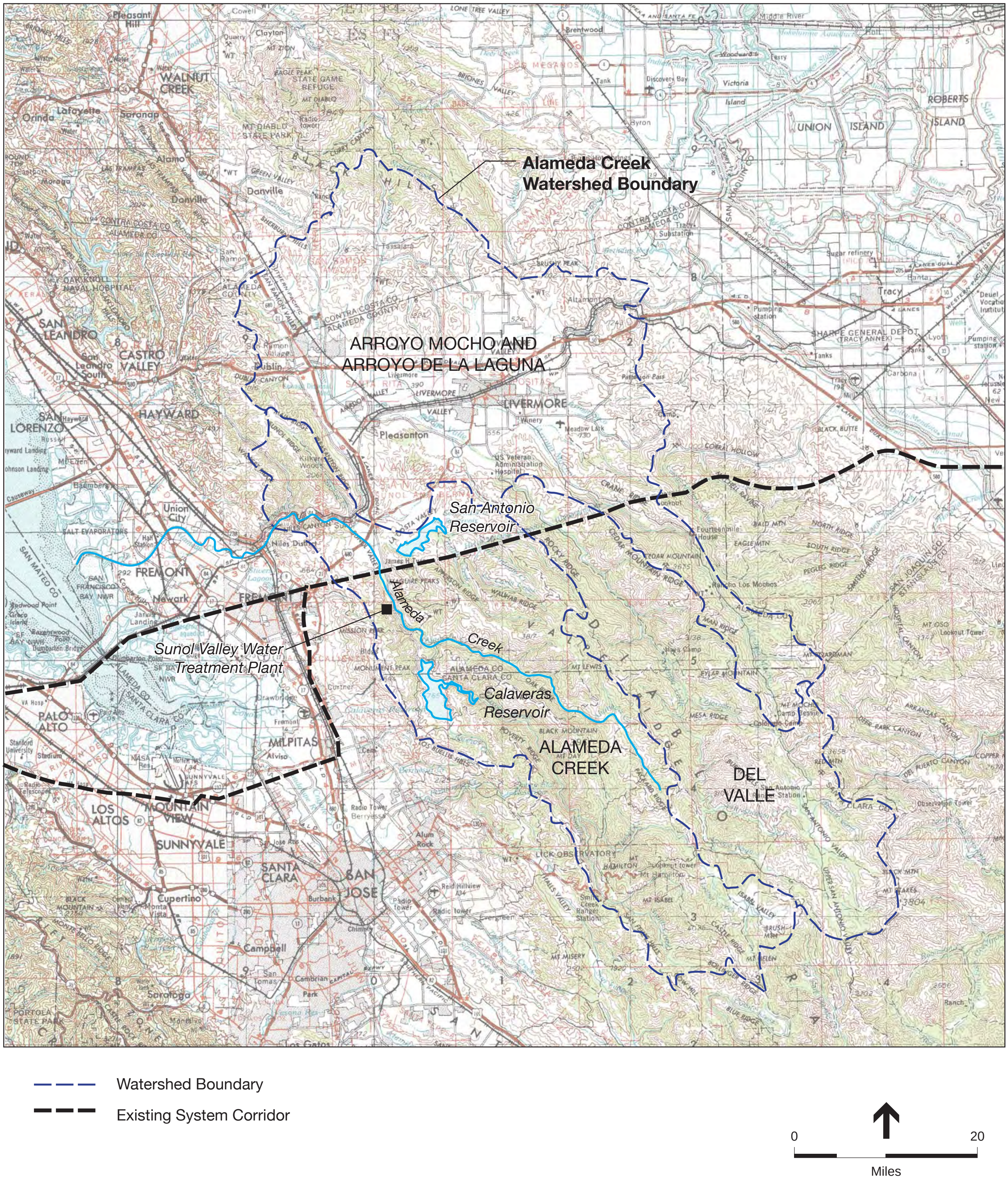
5.4.1.1 Setting

Watershed Overview

The Alameda Creek watershed covers an area of about 633 square miles in the East Bay, 30 miles southeast of San Francisco (**Figure 5.4.1-1**). Precipitation in the watershed is primarily in the form of rainfall, most of which falls in the November through March rainy season. Average annual precipitation ranges from about 20 to 25 inches per year; precipitation is heaviest in the west at higher elevations, and lowest in the eastern part of the watershed and at lower elevations.

There are two major drainage basins within the greater watershed: the Livermore Drainage Unit (shown as Arroyo Mocho and Arroyo de la Laguna in Figure 5.4.1-1) and the southern Alameda Creek watershed (also referred to as the Sunol Drainage Unit). The southern Alameda Creek watershed occupies about 175 square miles between Pleasanton to the north and Mount Hamilton to the south, spanning Alameda and Santa Clara Counties. Natural drainage is from the hills toward San Francisco Bay via Alameda Creek. The City and County of San Francisco (CCSF) owns 56 square miles (36,000 acres), or a little less than one-third, of the southern Alameda Creek watershed (shown in Chapter 2, Figure 2.2). The natural hydrology of the Alameda Creek watershed has been altered by water supply activities as well as by development and flood control.

Alameda Creek flows through a series of alluvial valleys linked by narrow bedrock-channel corridors. Alameda Creek is usually a perennial stream in the upper parts of the watershed, but in



SOURCE: ESA + Orion; USGS 1969

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Figure 5.4.1-1
Alameda Creek Drainage Area

the Sunol Valley and other alluvial flats, a high rate of infiltration and through-flow (water flowing through sediments) typically results in a dry creekbed during the summer months. The creek then resurfaces as pools in the confined bedrock canyons. Many of the tributaries that supply flows to the creek are historically intermittent and can be isolated from the main stem beginning in early to mid-summer (Gunther et al., 2000). The primary exception to this is Arroyo Hondo, which has year-round flow in many locations. In addition to fluctuations in stream flow caused by varying levels of surface water runoff, flows in Alameda Creek tributaries also vary greatly with rising and falling water tables in the area (Gunther et al., 2000). For the period from 1970 through 2003, Alameda Creek had an annual mean flow of 139 cubic feet per second (cfs), ranging from 31.5 cfs in the critically dry year of 1977 to 621 cfs in 1983. Mean flows are not indicative of daily flows, which can rise and fall dramatically depending on storm events. The highest peak flow (measured at the Niles gaging station) was 17,900 cfs on February 3, 1998. The total average annual runoff is 100,900 acre-feet (USGS, 2005a).

The SFPUC manages the Alameda Creek watershed portion of the regional system with the primary objective of conserving local watershed runoff for delivery to customers. Therefore, the Alameda reservoirs are managed to capture winter and early spring runoff in order to maximize storage and water delivery to customers during the winter months, while Hetch Hetchy runoff is stored for summer and fall delivery. This interconnectivity of the Alameda and Hetch Hetchy systems provides for substantial flexibility in operations, which are described in Chapter 2 and in this section.

The proposed WSIP system operations would affect the two SFPUC reservoirs in this watershed—Calaveras and San Antonio Reservoirs—as well as some reaches of Alameda Creek and its tributaries. These creeks and facilities are shown on **Figure 5.4.1-2**. Within the CCSF-owned watershed, Calaveras Creek and Arroyo Hondo drain directly to Calaveras Reservoir, and Alameda Creek flow is diverted into Calaveras Reservoir via the Alameda Creek Diversion Tunnel through operation of the Alameda Creek Diversion Dam (diversion dam). Farther downstream, San Antonio Creek drainage flows to San Antonio Reservoir, which is also used to store water from the Hetch Hetchy system and, periodically, water from Calaveras Reservoir. Downstream of its confluence with San Antonio Creek, Alameda Creek continues flowing through the Sunol Valley and then through Niles Canyon, eventually draining to San Francisco Bay. The drainage areas of each of these sub-watersheds of Alameda Creek are shown in **Table 5.4.1-1**.

Alameda Creek below the diversion dam conveys flows through the Sunol Valley, then to Niles Canyon and eventually to San Francisco Bay. As shown in Figures 5.4.1-1 and 5.4.1-2, tributaries include Calaveras Creek, which conveys releases from Calaveras Reservoir; Welch Creek, which flows into Alameda Creek near the Sunol Valley Water Treatment Plant (WTP); San Antonio Creek, which conveys releases from San Antonio Reservoir; Arroyo de la Laguna, which conveys flows from the Livermore Drainage Unit and Del Valle Drainage Unit; and Stoneybrook Creek, which enters Alameda Creek from the north within Niles Canyon.

TABLE 5.4.1-1
AREAS OF ALAMEDA CREEK SUB-WATERSHEDS IN THE WSIP STUDY AREA

	Sub-Watershed Area	
	Acres	**Square Miles**
Calaveras Reservoir	**62,662**	**97.9**
Arroyo Hondo	51,969	81.2
Calaveras Creek	10,693	16.7
Upper Alameda Creek (above diversion dam)	**21,679**	**33.9**
Mid Alameda Creek	**19,488**	**30.5**
Diversion dam to USGS gage at Calaveras Creek confluence	4,553	7.1
Calaveras Creek confluence gage to San Antonio Creek confluence	10,189	16
San Antonio Creek confluence to Arroyo de la Laguna confluence	4,746	7.4
San Antonio Reservoir	**24,645**	**38.5**

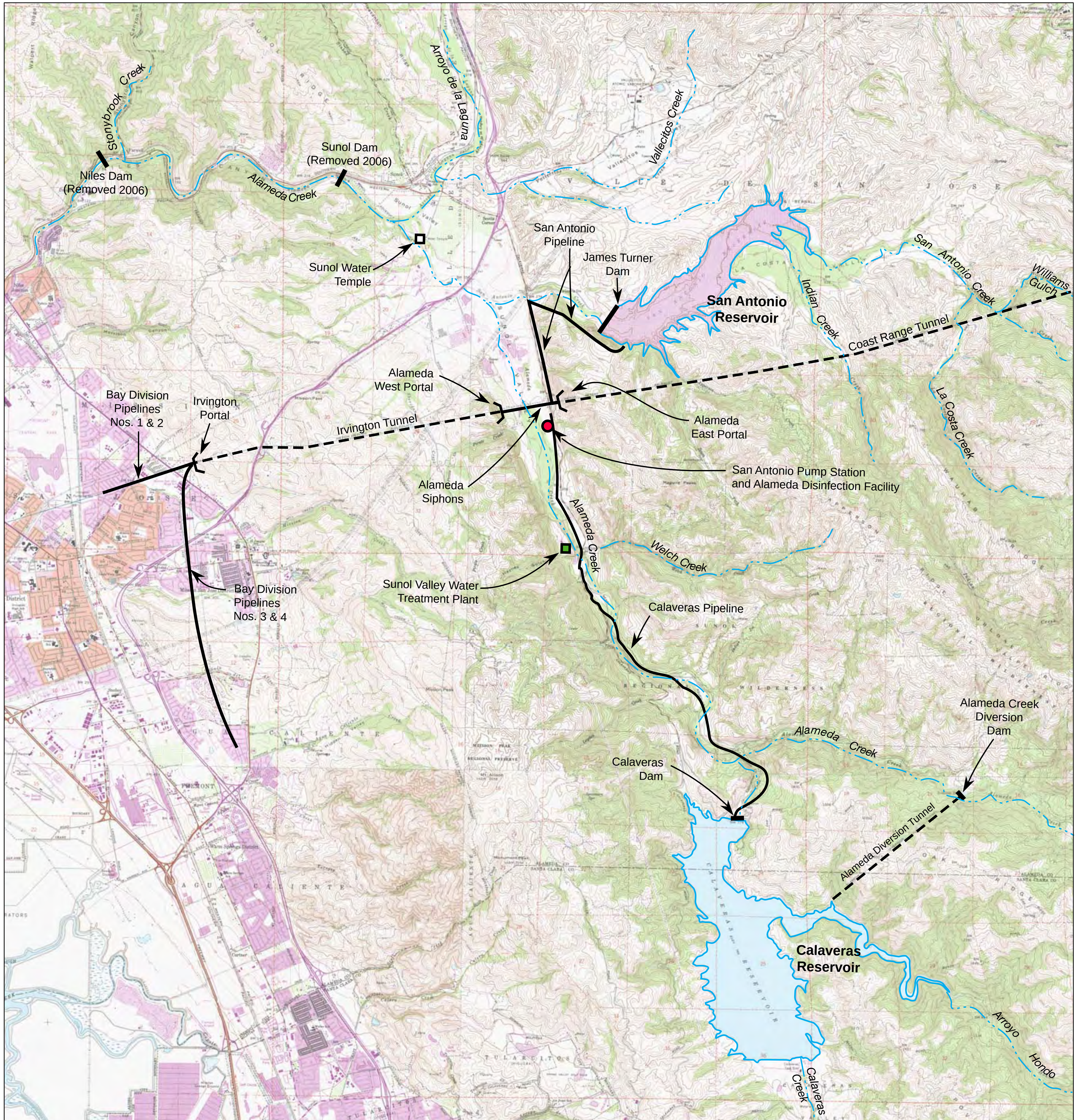
SOURCE: EDAW, 2007.

The reach of Alameda Creek through the Sunol Valley has a low gradient, with an elevation change of about 80 feet in five river miles. The creek channel is wide and braided in places; long sections have very shallow depths of water when flows are below about 75 cfs (Entrix, 2004). The Sunol Valley is broad but is bordered in parts by steep slopes (Center for Ecosystem Management and Restoration, 2002).

The reach of Alameda Creek through Niles Canyon, which starts downstream of the confluence with Arroyo de la Laguna, is constrained on both sides by steep canyon walls. There are several instream structures in this reach, including a culvert at the Stoneybrook Creek confluence and a U.S. Geological Survey (USGS) weir (Center for Ecosystem Management and Restoration, 2002). In 2006, the SFPUC completed removal of the Sunol and Niles Dams as part of an effort to restore creek flows and fish habitat along this reach of Alameda Creek; these facilities were historical parts of the regional water system that were built prior to construction of the Hetch Hetchy system.

After exiting Niles Canyon, Alameda Creek is contained within a flood control channel for 12 miles until it reaches San Francisco Bay. The Alameda County Water District (ACWD) manages this part of the creek for water supply, and the Alameda County Flood Control and Water Conservation District (ACFCWCD) maintains the channel for flood control purposes. Three large, inflatable rubber dams span the width of the channel and divert water to several hundred acres of ponds (former gravel quarries), where water percolates to recharge the underlying Niles Cone Groundwater Basin, a major source of water supply for the ACWD (ACWD, 2007). A flow control structure known as the BART weir (owned by the ACFCWCD and located where the BART and railroad tracks cross Alameda Creek in Fremont) provides structural protection of the footings of the BART and railroad bridge crossing and is a barrier to fish passage along this reach.

Mean annual precipitation over lower portions of the Alameda Creek drainage is about 20 inches.



SOURCE: ESA + Orion; USGS 1969

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Figure 5.4.1-2
Alameda Watershed Facilites

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Calaveras Reservoir and Creek

Calaveras Reservoir

Calaveras Reservoir was constructed between 1913 and 1925 with a storage capacity of 96,800 acre-feet, corresponding to a spillway elevation of 756 ft (USGS datum). Since December 2001, in response to safety concerns about the seismic stability of the dam and mandates from the California Department of Water Resources, Division of Safety of Dams (DSOD), the SFPUC has operated Calaveras Reservoir with the goal of holding the maximum water level at about 705 feet or below (USGS datum), which is approximately 37,800 acre-feet (roughly 40 percent of its maximum capacity). Because of heavy spring rains, Calaveras Reservoir has reached elevations of 720 to 736 feet for a few months during the springs of 2005, and 2006, as shown on **Figure 5.4.1-3**.

The natural drainage basin contributing to the Calaveras Reservoir drainage includes the Arroyo Hondo and Calaveras Creek Subbasins as well as local drainage areas along the west shore of the reservoir, with a total area of approximately 98 square miles. Stream flows within the Calaveras Reservoir drainage are highest during the winter and early spring rainy season and are minimal in summer and early fall. Calaveras Creek and Arroyo Hondo provide an average combined inflow to Calaveras Reservoir of about 36,000 acre-feet per year (afy) (nearly 12 billion gallons per year) (Bookman-Edmonston Engineering, Inc., 1995). Under pre-2002 conditions,[1] diversions from Alameda Creek added an average of approximately 6,000 afy (about 17 percent) to inflows into Calaveras Reservoir.

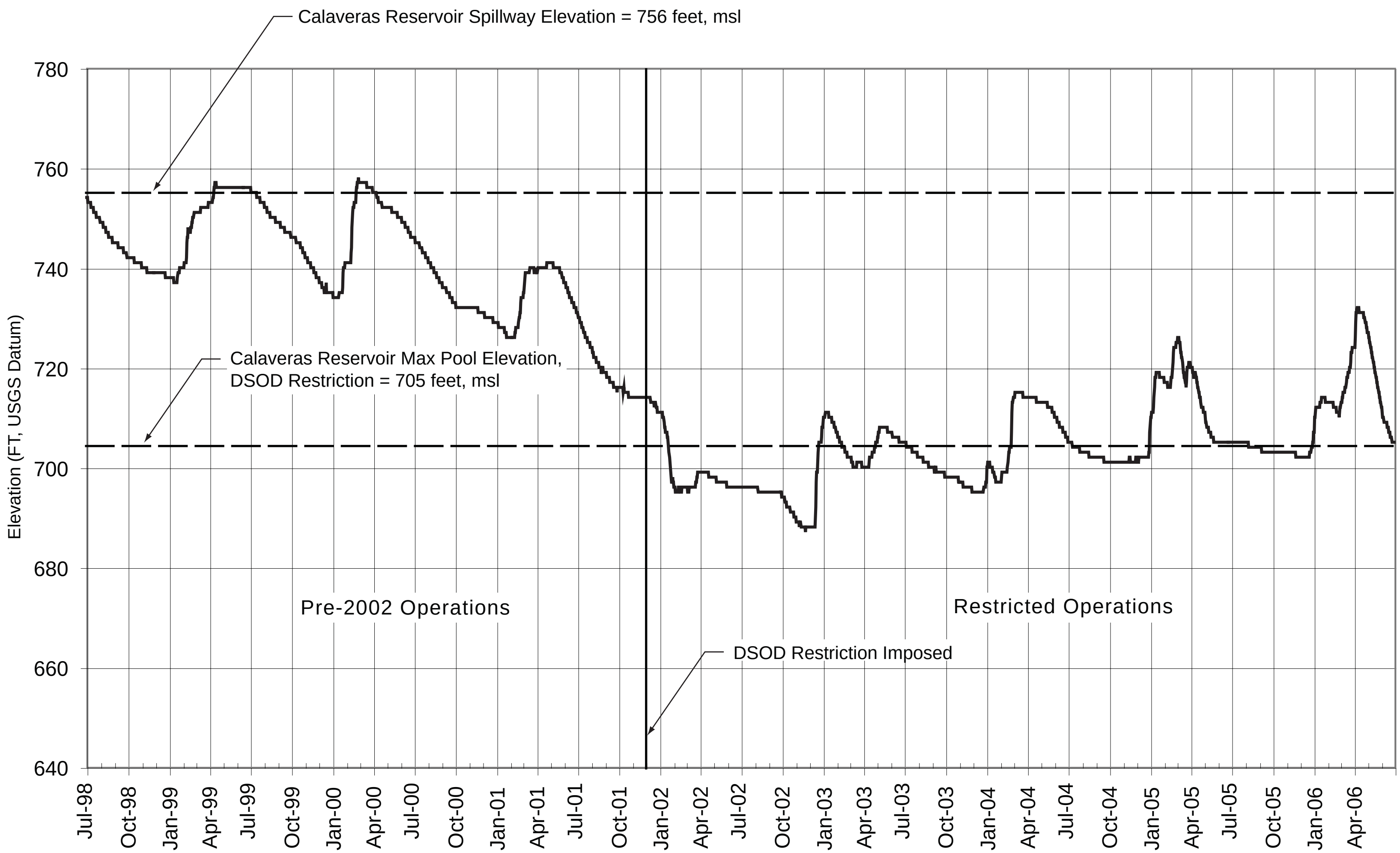
Water from the 35 square miles that drains into Alameda Creek upstream of the diversion dam can be diverted to Calaveras Reservoir through the Alameda Creek Diversion Tunnel. As shown in Figure 5.4.1-2, the diversion tunnel is situated about two miles upstream from the confluence with Calaveras Creek. At this overflow-type diversion, stream flow backs up behind an impoundment, flows into a short canal, and then enters the diversion tunnel if the diversion dam gates are open. During these conditions, flow in Alameda Creek in excess of the capacity of the diversion tunnel flows over the diversion dam and continues down Alameda Creek.

Much of the land surrounding Calaveras Reservoir is eroded or highly susceptible to erosion, and the subbasins of Calaveras Creek and Arroyo Hondo also contain eroded and steep soils. Above the diversion dam, slopes along Alameda Creek are eroded or severely eroded, with slope angles as high as about 45 percent (San Francisco Planning Department, 1999).

The SFPUC operates Calaveras Reservoir to meet the following objectives:

- Maximize storage within the reservoir to meet potential drought and water supply needs
- Maximize conservation of runoff on a long-term basis
- Meet short-term water supply operational requirements

[1] Calaveras Reservoir operations before the 2001 DSOD restrictions are referred to throughout this document as "pre-2002 operations"; pre-2002 conditions are associated with pre-2002 operations.



SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-3
Calaveras Reservoir, Historical Water Levels, 1998 to 2006

Normal releases from Calaveras Reservoir are made through the intake tower. Under pre-2002 conditions, water could be withdrawn from three reservoir depths, corresponding to the elevations of the intake openings (adits) in the intake tower. However, the top adit is above the 705-foot restricted reservoir level; therefore, under current conditions, water can only be drawn from the lower two adits. Water from the tower's vertical conduit is conveyed through the 4.1-mile-long Calaveras Pipeline to the Sunol Valley WTP.

Water from Calaveras Reservoir is treated at the Sunol Valley WTP before entering the transmission system. Water flows from the reservoir to the treatment plant by gravity. The Sunol Valley WTP treats the water, which then travels by gravity to the transmission system at the Alameda Siphon No. 2. System operators have also transferred water from Calaveras Reservoir to San Antonio Reservoir as part of DSOD-restricted operations, in addition to making deliveries to the Sunol Valley WTP and releases via the cone valve.

Before December 2001, the reservoir would typically be operated to fill by the end of the rainy season in normal or wet years. The reservoir would be drawn down 15,000 to 20,000 acre-feet by early winter to ensure sufficient capacity to capture winter runoff. During a drought or water supply emergency, the reservoir would be drawn down farther to meet SFPUC water supply needs.

Following periods of heavy inflow, reservoir storage rises temporarily; at such times, the SFPUC employs "best efforts" to lower the level by releasing water to the regional system, and, if necessary, discharging excess inflow to Calaveras Creek. Average monthly storage in Calaveras Reservoir under restricted operations ranges from about 28,000 to 38,000 acre-feet in all conditions and months. As indicated in Figure 5.4.1-3, recent historical elevations in Calaveras Reservoir have varied from about 690 to 755 feet, with maximum post-2001 elevations of up to 736 feet. The SFPUC has also maintained a minimum water level elevation of 690 feet in accordance with a 1991 letter sent to the California Department of Fish and Game (CDFG) (SFPUC, 2005), as described in Chapter 2, Section 2.5.3.

In 1997, the CCSF and CDFG signed a Memorandum of Understanding (MOU) regarding releases of water from Calaveras Reservoir and maintenance of minimum storage levels from July through October to enhance fishery habitat, improve the coldwater fishery resources downstream of Calaveras Dam, and enhance warm-water fisheries in the lower reach of the creek. The SFPUC agreed to use best efforts to maintain at least 30,000 acre-feet in the reservoir (690-foot elevation) as well as to release up to 6,300 afy from Calaveras Reservoir. The MOU indicated possible year-round releases if target flows below the confluence of Alameda and Calaveras Creeks were not met. However, implementation of the 1997 MOU instream flow requirement below Calaveras Reservoir is currently on hold and hindered by the lack of sufficient cold-water storage in Calaveras Reservoir. (MOU flows are shown below in Table 5.4.1-9.)

Calaveras Creek Below Calaveras Dam

As part of system operations, the SFPUC can make releases from Calaveras Reservoir to Calaveras Creek, which then flow to Alameda Creek. Controlled emergency releases and other controlled releases (i.e., for fish studies) can be made through the dam outlet works, which can release up to about 1,100 cfs. Uncontrolled releases are conveyed to Calaveras Creek through the spillway structure. Spillway discharges could exceed 33,000 cfs if the reservoir were to fill to an elevation near the top of the dam.

Uncontrolled releases (spills) over the Calaveras Dam spillway have been infrequent. Recorded spills since 1938 have occurred in the following water years: 1941, 1945, 1952, 1956, 1958, 1965, 1967, 1969, and 1996–2000, as shown in **Table 5.4.1-2**.

TABLE 5.4.1-2
HISTORICAL CALAVERAS RESERVOIR SPILLWAY RELEASES (UNCONTROLLED)

Date	Average Daily Spill (cfs)
02/18/41 – 03/21/41	438
03/30/41 – 04/21/41	518
04/09/45 – 05/05/45	137
01/11/52 – 02/20/52	634
02/28/52 – 03/06/52	49
03/08/52 – 04/09/52	379
04/27/52 – 05/26/52	128
01/18/56 – 02/09/56	515
02/23/56 – 05/06/56	254
03/17/58 – 05/29/58	574
04/12/65 – 05/08/65	431
04/03/67 – 05/15/67	540
02/25/69 – 05/15/69	378
01/28/96 – 04/30/96	506
01/03/97 – 02/22/97	592
02/06/98 – 06/17/98	439
04/13/99 – 07/02/99	31
02/24/00 – 03/30/00	497

SOURCE: SFPUC, 2006.

The spillway has not been used since the 2001 DSOD restrictions were placed on reservoir storage. Reservoir storage rises temporarily following periods of heavy inflow, and the SFPUC attempts to lower the reservoir level by releasing water to the Sunol Valley WTP and occasionally discharging water through the cone valve to Calaveras Creek. **Table 5.4.1-3** summarizes the releases made through the cone valve since the imposition of DSOD restrictions. As stated above, 1997 MOU fishery releases from Calaveras Reservoir are on hold due to the lack of sufficient cold-water storage in the reservoir.

Alameda Creek Above the Diversion Dam

Alameda Creek above the diversion dam has a reach length of about 14.9 miles, with an average slope of about 125 feet per mile. The average annual stream flow in Alameda Creek at the diversion dam has been estimated at 12,000 acre-feet (Bookman-Edmonston Engineering, Inc., 1995). As shown in **Table 5.4.1-4**, upper Alameda Creek is “flashy”; the creek has brief periods

TABLE 5.4.1-3
APPROXIMATE CALAVERAS CONE VALVE RELEASES SINCE 2001 (CONTROLLED)

Dates	Release
12/2001 – 02/2002	37,385 acre-feet at @ 375 cfs
03/2005 – 05/2005	33,574 acre-feet at @ 373 cfs
03/2006 – 06/2006	65,402 acre-feet at @ 336 cfs
Cone valve closed 6/23/2006	

NOTE: Variations in the identified release rates have occurred within these times periods.

SOURCE: SFPUC, 2006.

of high flows interspersed with longer periods of low flows. Because the table shows daily means, it substantially understates the "flashiness" of the creek, where peak flows may occur for a few hours or less. As indicated on **Table 5.4.1-5**, measured peak flows at the diversion dam have exceeded 650 cfs on 48 days in the past 11 years, or an average of about four days per year. Despite the rarity of these flows, they constitute a substantial amount of stream flow volumes.

Alameda Creek Between the Diversion Dam and Calaveras Creek Confluence

Alameda Creek from the diversion dam to Calaveras Creek is 2.85 miles long with an average slope of 190 feet per mile. This reach has areas of boulders and pools with a segment of gorge carved through sandstone deposits, including the "Little Yosemite" area. Peak flows typically occur in the December through May rainy season. Minimal flows occur from July through October.

The diversion dam includes a dam/spillway, a sluice gate at the bottom of the dam that is used annually to wash out sediments that have accumulated behind the dam, as well as to pass flows when the tunnel gates are closed, a diversion sluiceway that directs water to the diversion gates, and a second sluice gate in the diversion sluiceway. The entire facility is remote (accessed via an unpaved road from the Sunol Regional Wilderness staging area) and, due to a lack of power availability, the gates must be manually operated. There is a gaging station in Alameda Creek immediately upstream of the diversion dam; the nearest Alameda Creek station below the diversion dam is immediately downstream of the creek's confluence with Calaveras Creek.

Prior to 2002, most of the flows were diverted to Calaveras Reservoir via the diversion tunnel. The maximum capacity of the diversion tunnel is about 650 cfs. Typical operation involves opening the diversion tunnel gates in early winter and leaving them open throughout the rainy season, except when Calaveras Reservoir is full. To avoid the need to spill water from Calaveras Reservoir when it is full, the SFPUC closes the gates at the diversion tunnel so that stream flow in Alameda Creek continues down its natural course. The diversion dam does not divert all flows when the diversion gates are open; due to through-flow as well as seepage through the dam and its sluice gates, flows of less than 1 cfs (and possibly somewhat higher) flow through the dam and down the creek.

TABLE 5.4.1-4
HISTORICAL RECORD OF ALAMEDA CREEK FLOW ABOVE THE DIVERSION DAM
(cubic feet per second)

Day of month	Maximum of Daily Mean Values for 11 Years of the Hydrologic Record (October 10, 1994 – September 30, 2005)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	533	212	121	75	54	14	5.8	2.6	1.4	0.74	0.83	18
2	868	387	94	60	52	13	5.8	2.4	1.3	0.99	0.82	126
3	525	1,120	89	72	208	13	5.7	2.3	1.3	0.97	0.83	63
4	234	562	392	77	133	13	5.5	2.1	1.3	0.92	0.84	18
5	521	518	463	65	84	12	4.9	2.0	1.4	0.88	0.84	300
6	211	666	238	67	64	12	4.5	2.0	1.4	0.78	0.84	89
7	432	900	168	84	45	13	4.3	2.0	1.3	0.62	1.0	124
8	447	679	163	110	29	13	4.3	1.9	1.4	0.64	84	170
9	395	628	202	135	22	12	4.3	1.9	1.5	0.64	54	43
10	1,200	229	817	80	19	12	4.2	1.9	1.5	0.64	3.9	601
11	476	121	599	225	18	11	4.1	1.8	1.3	0.81	1.6	222
12	621	253	354	180	23	11	4.0	1.8	1.2	0.92	1.5	242
13	264	483	243	123	91	10	3.8	1.8	0.95	0.80	1.4	187
14	395	672	164	91	77	9.6	3.7	1.8	0.92	0.80	1.3	206
15	637	274	134	73	66	12	3.5	1.7	1.1	0.80	1.1	204
16	457	288	116	64	49	18	3.5	1.8	0.89	0.80	1.4	584
17	175	151	104	56	39	13	3.3	1.8	0.84	0.71	354	267
18	358	264	94	51	35	11	3.2	1.8	1.1	0.76	68	74
19	461	848	88	47	32	10	3.1	1.8	0.87	0.77	21	161
20	479	733	311	43	29	9.5	3.0	1.7	0.87	0.81	25	443
21	290	863	367	39	26	8.8	3.0	1.7	1.1	0.75	13	602
22	715	545	1,090	37	25	8.1	3.0	1.7	1.1	0.76	62	591
23	754	430	903	36	23	7.6	3.0	1.6	1.2	0.77	55	224
24	693	268	495	36	22	7.1	3.0	1.6	1.2	0.80	23	104
25	792	206	281	43	20	7.0	3.0	1.6	1.3	1.5	13	63
26	679	552	180	68	19	6.8	2.9	1.6	1.4	1.0	34	50
27	616	408	126	46	18	6.4	2.8	1.6	1.4	0.92	36	45
28	376	243	203	142	20	6.2	2.8	1.5	1.4	0.92	11	101
29	263	177	146	83	23	6.1	2.8	1.5	1.4	1.4	7.8	324
30	127	–	107	64	18	5.8	3.1	1.4	1.4	1.2	20	452
31	414	–	79	–	15	–	2.7	1.4	–	0.95	–	470

Note: Flows in excess of 650 cfs are shaded; flows above 650 cfs flow past the diversion dam to the downstream reaches of Alameda Creek.

SOURCE: USGS, 2005b.

Diversions have substantially changed the hydrograph (i.e., a graph that shows the pattern of flows—both peak volumes and duration) of this reach of Alameda Creek. Pre- and post-diversion downstream flows in a typical above-normal-water-year storm are discussed below in Section 5.4.1.2, Impacts (see Figures 5.4.1-9, 5.4.1-10, and 5.4.1-11). Nearly all of the downstream flows below 650 cfs were diverted from the creek, and the peak flows were halved. The resulting hydrograph was that of a much smaller storm in a dry year. The effect of diversions on smaller storms (those with instantaneous flows of less than 650 cfs) was even more dramatic, with nearly all flows being removed from the creek downstream. The creek segment below the diversion dam essentially reverted to very low-flow conditions during these lesser storm events.

TABLE 5.4.1-5
NUMBER OF DAYS ALAMEDA CREEK EXCEEDED 650-CFS FLOW, MEASURED ABOVE THE DIVERSION DAM – 1997 TO 2007

Water Year	Hydrologic Year Type	Ranking	Number of Days with Flow Rates Exceeding 650 cfs
1997	Wet	10	11
1998	Wet	2	14
1999	Above Normal	32	2
2000	Above Normal	30	8
2001	Below Normal	50	0
2002	Below Normal	57	0
2003	N/A	N/A	2
2004	N/A	N/A	0
2005	N/A	N/A	6
2006	N/A	N/A	4
2007	N/A	N/A	1

SOURCE: USGS, 2005b.

The SFPUC estimates that, prior to lowering Calaveras Reservoir water levels (pre-2002 conditions), about 8,000 afy had been diverted from Alameda Creek to Calaveras Reservoir in years with normal rainfall, with lesser diversions in dry and below-normal years. In wet years following drought periods, higher diversion quantities could occur, and in dry years, diversions could be much lower.

As a result of Calaveras Reservoir's restricted capacity, the SFPUC has had to significantly reduce its diversions through the Alameda Creek Diversion Dam compared to its 70-year historical operation. Since 2002, both the total quantities of diverted flows and the number of days of diversions have been substantially reduced. In addition, SFPUC records indicate that the diversion valves were only opened for about 35 days in 2002 (November 13 to December 18), about 80 days in 2003 (February 13 to May 2), and 25 days in 2004 (September 29 to October 24), and were not opened for over two years (between late October 2004 and early March 2007). As a result, most flows in Alameda Creek bypassed the diversion dam and continued on into this reach between 2002 and March 2007.

Alameda Creek Below the Calaveras Creek Confluence

Alameda Creek between Calaveras Creek and San Antonio Creek is about 3.3 miles long, with an average slope of 22 feet per mile. Except for the infrequent periods of releases and/or spills from Calaveras Reservoir (see Tables 5.4.1-2 and 5.4.1-3), flows in Alameda Creek below its confluence with Calaveras Creek are similar to, but slightly greater than, those described above for Alameda Creek at the diversion dam. Typical flows are discussed below in Section 5.4.1.2, Impacts.

San Antonio Reservoir

The James H. Turner Dam, which impounds San Antonio Reservoir, was constructed in 1965, approximately one mile upstream of San Antonio Creek's confluence with Alameda Creek and approximately 2.5 miles southeast of the town of Sunol. Above its toe, the dam is about 190 feet high and has a crest elevation of 468 feet (USGS datum).

The catchment area of the reservoir is about 40 square miles. The CCSF owns most of the drainage area north and northeast of San Antonio Reservoir (as shown in Chapter 2, Figure 2.2). These lands extend eastward to include the downstream portions of each of the major contributing creeks (Indian Creek, La Costa Creek, and Williams Gulch, shown in Figure 5.4.1-2) and are considered part of the primary watershed of the reservoir. The upstream portions of the tributaries, however, are outside of CCSF ownership and include large areas of eroded and erodible lands. Stream flows into San Antonio Reservoir are highest during the winter and spring rainy season and become insignificant in summer and early fall. Average annual stream flow into San Antonio Reservoir has been estimated at 7,200 acre-feet (Bookman-Edmonston Engineering, Inc., 1995).

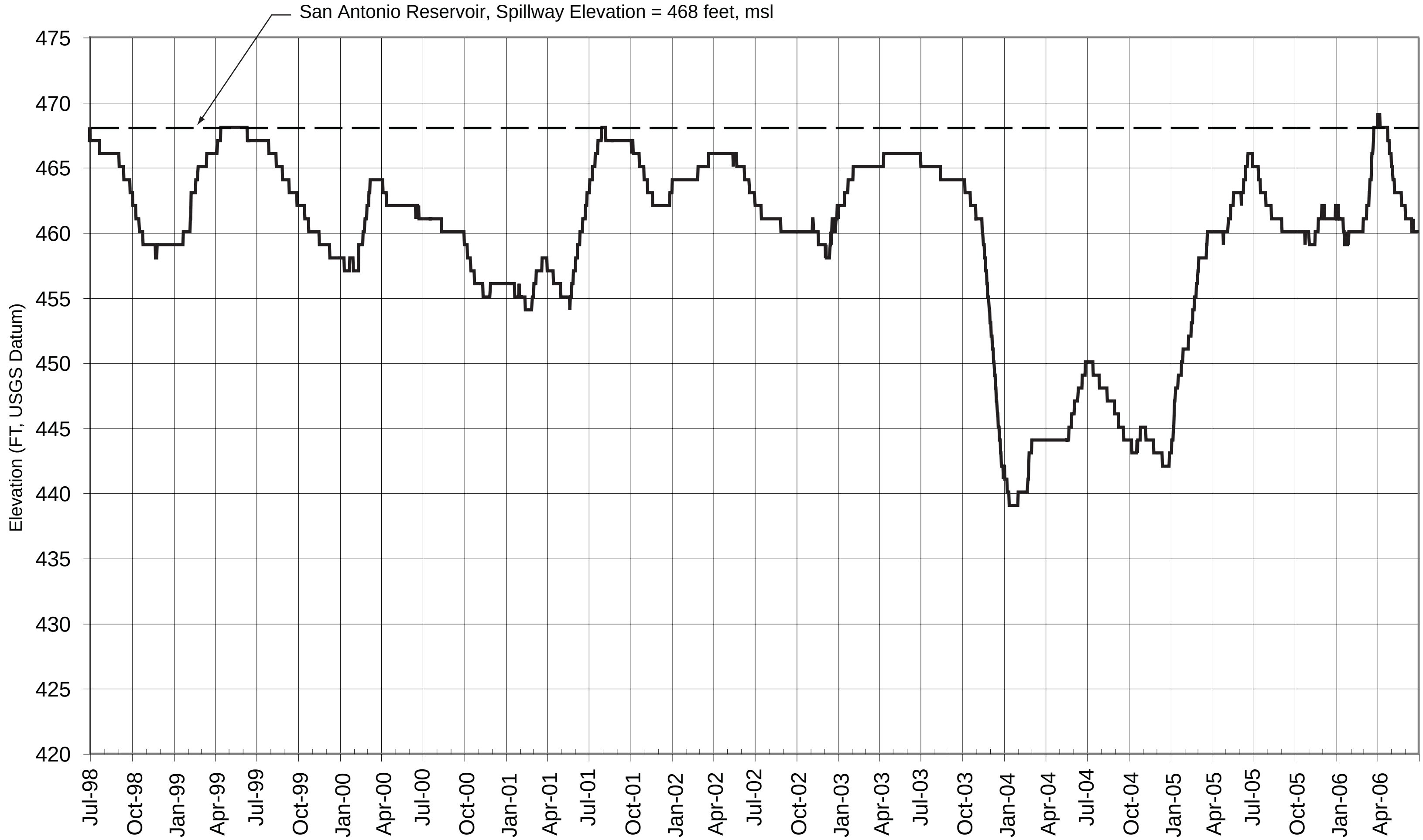
As described above, San Antonio Reservoir normally receives inflow from the San Antonio Creek watershed and imported water from the Hetch Hetchy Aqueduct (as described in Chapter 2, Section 2.2.3). In addition, the reservoir has been used to store South Bay Aqueduct emergency water, groundwater (influenced by surface water) pumped from the infiltration galleries at the Sunol Water Temple, and Calaveras Reservoir surplus flows. The initial capacity of the reservoir was 50,300 acre-feet. Sedimentation since its construction has reduced its maximum capacity by about 2 percent, to roughly 49,500 acre-feet. Average monthly storage in San Antonio Reservoir does not vary substantially from month to month or year to year, ranging from about 39,000 to 50,300 acre-feet in all conditions and months. As shown in **Figure 5.4.1-4**, reservoir levels have ranged from about 440 to 468 feet. The average annual rainfall near San Antonio Reservoir is about 20 inches per year (San Francisco Planning Department, 1999).

Reservoir Operations

The SFPUC operates San Antonio Reservoir to receive and store dechlorinated water from the Hetch Hetchy Aqueduct as well as local watershed runoff. Hetch Hetchy water can be stored in San Antonio Reservoir by diverting it from the Alameda Siphons via the San Antonio Pump Station through the San Antonio Pipeline. Although not part of normal operations, surplus water from Calaveras Reservoir can flow by gravity through the Calaveras and San Antonio Pipelines to be stored in San Antonio Reservoir.

Water from San Antonio Reservoir is treated at the Sunol Valley WTP before entering the transmission system. San Antonio Reservoir water can flow to the Sunol Valley WTP by gravity when the water level in the reservoir is above 445 feet. Below this elevation, the water must be pumped via the San Antonio Pump Station. The Sunol Valley WTP treats the water before it reenters the system by gravity-flow through the Alameda Siphons.

As part of system operations, the SFPUC can make releases from San Antonio Reservoir to San Antonio Creek, which then flow to Alameda Creek. Controlled releases through the



SOURCE: SFPUC, HH/LSM (see Appendix H)

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Figure 5.4.1-4

San Antonio Reservoir, Historical Water Levels, 1998 to 2006 emergency discharge valve on Turner Dam and uncontrolled releases (spills over the spillway) are discharged to San Antonio Creek. Uncontrolled releases flow over the spillway structure, an 80-foot-long weir with a crest elevation of 468 feet. The SFPUC estimates the spillway capacity at 13,500 cfs for a reservoir water level of 480 feet.

San Antonio Creek Below San Antonio Reservoir

Modeled uncontrolled releases from San Antonio Reservoir to San Antonio Creek average about 1,000 afy, ranging from no releases in below-normal and dry years to about 3,200 acre-feet in very wet years. Actual dam operation makes adjustments to prevent spill such that less water is spilled than predicted by the model. Currently, there are no releases from June through December; the highest releases typically occur in February and March. For much of the year, this stream reach is dry. San Antonio Creek joins Alameda Creek in the lower reaches of the Sunol Valley in the vicinity of the quarries and upstream of Arroyo de la Laguna.

Alameda Creek Below the San Antonio Creek Confluence

The reach of Alameda Creek through the Sunol Valley (both upstream and downstream of the confluence with San Antonio Creek) has a low gradient, with an elevation change of about 80 feet in five river miles. The Sunol Valley is broad but is bordered in parts by steep slopes (Center for Ecosystem Management and Restoration, 2002). In the lower reaches of the Sunol Valley, Alameda Creek is bordered by numerous gravel quarries, and much of the flow in the creek is lost to groundwater.

Since October 1999, the USGS has monitored mean daily flows in Alameda Creek downstream of Welch Creek, at about the location of the Sunol WTP. Mean daily flows generally range from near zero during dry months to above 1,000 cfs in wet months. The highest mean daily flow recorded prior to lowering Calaveras Reservoir water levels was 1,070 cfs in late March. The highest mean daily flow since 2002 was 1,340 cfs in early April. During the month of May, flow rates are usually in the order of 50–100 cfs, decreasing to 20–50 cfs in June and 0–20 between July and November.

Peak flows in Alameda Creek at Welch Creek increased substantially after the closure of the diversion tunnel. In 2000 (a wet year), a peak flow rate of 2,910 cfs was recorded. If the tunnel intake had been closed, the flow would have been about 650 cfs greater.

5.4.1.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to stream flow, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially alter stream flows such that they are outside the range of pre-WSIP conditions and result in substantial hydrologic changes

In addition to direct impacts resulting from changes in stream flows and reservoir levels, this PEIR also considers indirect impacts. These include impacts related to geomorphology, surface water quality, groundwater, fisheries, terrestrial biological resources, and recreational and visual resources. Each of these topics is discussed in its own section in this chapter. It should be noted that there might be cases in which significant indirect impacts could result from less-than-significant direct impacts.

Approach to Analysis

As discussed above in Section 5.4.1.1, DSOD-imposed restrictions on Calaveras Reservoir capacity substantially altered SFPUC operations and, as a result, changed the hydrologic conditions in Alameda Creek, Calaveras Creek, and Calaveras Reservoir (i.e., flow diversions from Alameda Creek have been reduced or halted and reservoir levels lowered). These hydrologic conditions will continue until the Calaveras Dam project (SV-2) is implemented, which would restore the original reservoir capacity. Therefore, these hydrologic conditions will have occurred for 10 years or more (from 2002 through approximately 2012, the target date for reservoir refill). Once the dam is rebuilt and the reservoir refilled, the SFPUC would reinitiate operations that are similar to those it implemented prior to the DSOD restrictions, and the hydrologic conditions in Alameda Creek and Calaveras Reservoir would return to those that existed prior to the DSOD restrictions; that is, the SFPUC would again divert substantial flow from Alameda Creek to the reservoir and would maintain the reservoir water levels near the maximum storage level.

The SFPUC operates the Alameda Creek Diversion Dam to divert water from Alameda Creek into Calaveras Reservoir when such water can be stored. The SFPUC closes the ACDD Tunnel when diversions are not needed. As a result of the 2001 DSOD restriction on Calaveras Reservoir, the SFPUC has had to reduce the volume of water stored in Calaveras and has therefore significantly reduced its diversions through the Alameda Creek Diversion Dam by closing the tunnel more frequently compared to its 70-year historic operation. Upon completion of the Calaveras Dam Replacement project (SV-2), the SFPUC would no longer have DSOD restrictions on storage level in Calaveras Reservoir. Compared to historical operations with full storage capacity at Calaveras, the SFPUC plans to maintain Calaveras Reservoir at a higher elevation over long periods of time, and as a result the diversion tunnel would be closed more often than historically and there would be more occasions when water bypasses the Alameda Creek Diversion Dam into Alameda Creek (see Appendix H2-2, Table 2.7-7).

For the purpose of impact analysis, CEQA Guidelines Section 15125(a)[2] considers the existing conditions baseline to be those conditions in existence at the time the environmental review is initiated, as marked by issuance of the notice of preparation (NOP). For the WSIP, the existing baseline used for the impact analysis reflects the range of hydrologic conditions that have resulted since the DSOD restrictions were imposed in December 2001 and continued through issuance of the NOP in 2005, and which are expected to continue until such time that a restored reservoir

[2] CEQA Guidelines Section 15125(a) states that an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time the NOP is published, and that this environmental setting will normally constitute the baseline physical conditions by which the lead agency determines whether an impact is significant.

begins refilling. This PEIR does not use the historical range of hydrologic conditions that existed prior to the DSOD restriction as the basis of impact analysis of the WSIP impacts on stream flow.

The following section addresses the impacts of the WSIP on water levels in Calaveras and San Antonio Reservoirs and flow along Calaveras, Alameda, and San Antonio Creeks. In applying the above significance criteria, very infrequent changes in reservoir levels and/or flow are not generally considered to generate a significant effect. Changes in stream flow and changes in reservoir storage and water levels attributable to the WSIP were estimated using the Hetch Hetchy/Local Simulation Model (HH/LSM). An overview of the model is presented in Section 5.1.4. Detailed information on the model and its underlying assumptions is provided in Appendix H.

This section compares modeled existing (2005) hydrologic conditions (with Calaveras Reservoir operated at its restricted capacity and assuming current operational priorities) to modeled post-WSIP 2030 conditions. The WSIP 2030 conditions assume full implementation of all proposed WSIP facility improvement projects, including the Calaveras Dam (SV-2) and Alameda Creek Fishery (SV-1) projects, as well as implementation of fishery releases and downstream recapture of those releases. In some cases, patterns from actual flow data were used to supplement results from the modeled data in order to provide additional detail and context for assessing potential impacts. Stream reaches are discussed separately below, and their interrelationships are highlighted.

Impact Summary

Table 5.4.1-6 presents a summary of the impacts on stream flow in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.1-6
SUMMARY OF IMPACTS – STREAM FLOW IN ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.1-1: Effects along Calaveras Creek below Calaveras Reservoir	LS
Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam	SU
Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek	LS
Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek	LS

LS = Less than Significant impact, no mitigation required
SU = Significant Unavoidable impact

Impact 5.4.1-1: Effects along Calaveras Creek below Calaveras Reservoir.

Calaveras Reservoir is currently operated to conserve local watershed runoff for integration into the SFPUC regional water supply; however, due to DSOD restrictions, the water level in Calaveras Reservoir has been considerably lower since the end of 2001 than in previous years.

Reservoir storage is constrained to approximately 37,800 acre-feet (except on a temporary basis), about 40 percent of its design capacity. Under the WSIP, Calaveras Reservoir would be restored to its full design capacity (approximately 96,800 acre-feet), which would allow the SFPUC to maximize the use of local watershed supplies. Furthermore, fishery releases from the proposed bypass flow structure at the Alameda Creek Diversion Dam and/or from the reservoir and flow recapture would be implemented under the WSIP in accordance with the 1997 MOU (compliance with the 1997 MOU is measured below the confluence of Alameda and Calaveras Creeks). The fishery releases from the diversion dam bypass flow structure to Alameda Creek and from Calaveras Reservoir to Calaveras Creek would be recaptured downstream and returned to the SFPUC water supply in compliance with the 1997 MOU.

Under existing and future modeled conditions, yearly Calaveras Reservoir storage operations are typically cyclical: the reservoir fills in the late winter/early spring and is depleted during the summer. During a drought, reservoir storage is further depleted by the slow, successive drawdown of reservoir storage that occurs due to required releases and the drafting of supplies to the Sunol Valley WTP that exceed runoff to the reservoir. The reservoir then refills after the drought, as the SFPUC strives to conserve local watershed runoff. Both the annual range and year-to-year range of variation in reservoir water levels would increase as the storage capacity of Calaveras Reservoir is restored.

Figure 5.4.1-5 illustrates the modeled chronological storage and stream releases from Calaveras Reservoir for both the existing condition and the WSIP using hydrologic data from the period 1920 to 2002. Releases to Calaveras Creek from Calaveras Reservoir represent both controlled releases through the cone valve and uncontrolled releases over the spillway. The graphs also show how peak flows in Calaveras Creek downstream of the dam tend to correspond to periods when Calaveras Reservoir is operating at or near capacity. This figure assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam; this represents a worst-case condition for the range of fluctuation in Calaveras Reservoir water levels.

As illustrated in the graphs, the most notable change that would occur under WSIP operations is that Calaveras Reservoir would be operated at a higher water surface elevation than at present; as the graphs show, the brown line (2030 WSIP conditions) is consistently at a much higher level than the blue line (existing conditions) for the 82-year period. Reservoir storage and water levels also show greater variation than under existing conditions, as illustrated by the wider range of fluctuation of the brown line (2030 WSIP conditions) compared to the blue line (existing conditions). The graphs also show that the restored reservoir storage would reduce peak releases (and therefore flows) into Calaveras Creek downstream of the dam under all but the heaviest wet-year storms; the releases are represented by the blue line (existing conditions) and magenta line

(2030 WSIP conditions) along the bottom of each graph, with the magenta line generally lower than the blue line except in the wettest years. Under actual operations to date, storage in the reservoir under restricted conditions has at times exceeded the DSOD target; as a result, more water has been temporarily held in storage than the model indicates (see Figure 5.4.1-3) and fewer releases have actually occurred than predicted by the model. This is because the model

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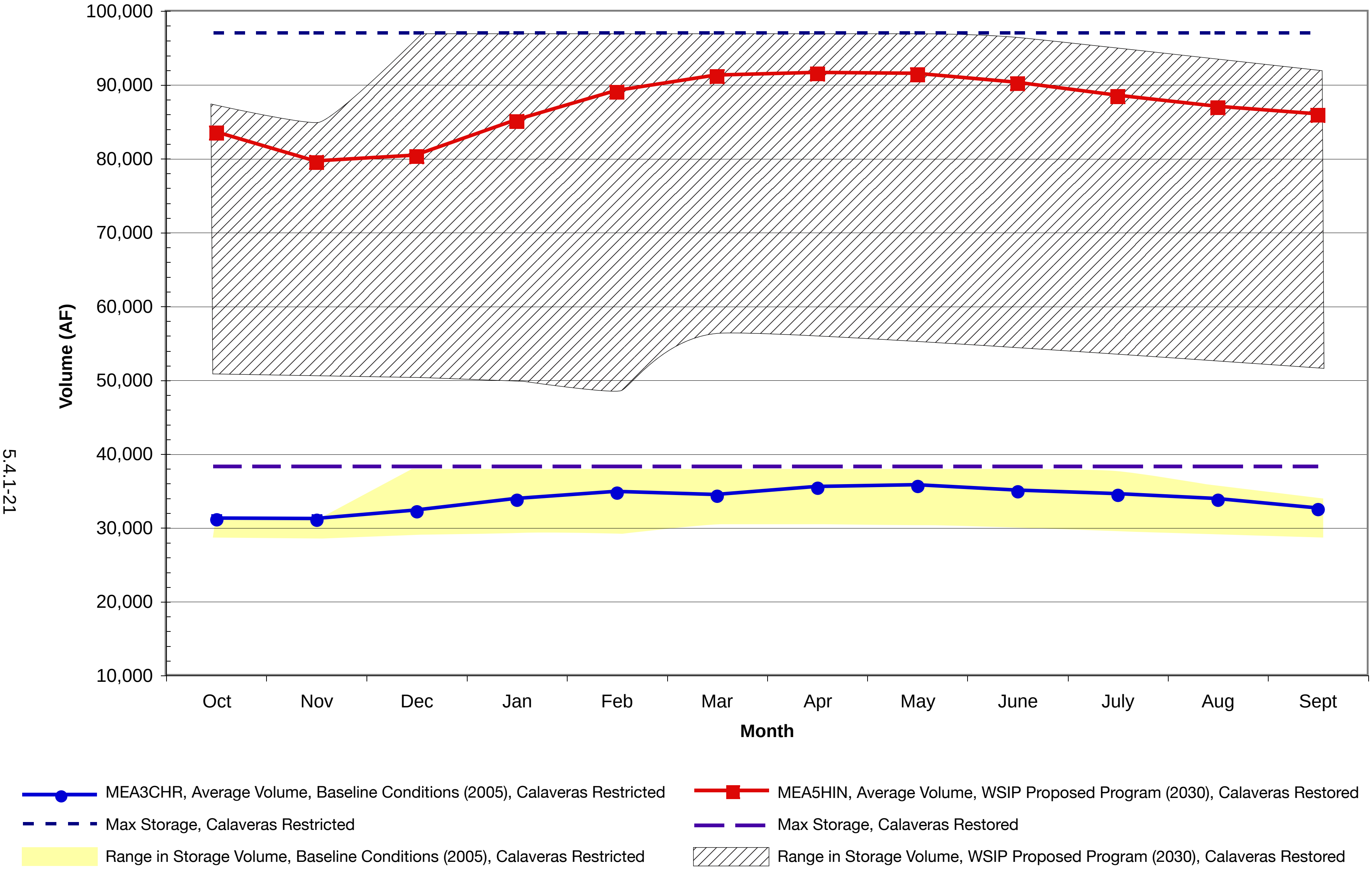
SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-5
Calaveras Storage and Releases to Calaveras Creek



SOURCE: SFPUC, HH/LSM (see Appendix H)

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Figure 5.4.1-6
Average Monthly Storage Volume,
Calaveras Reservoir

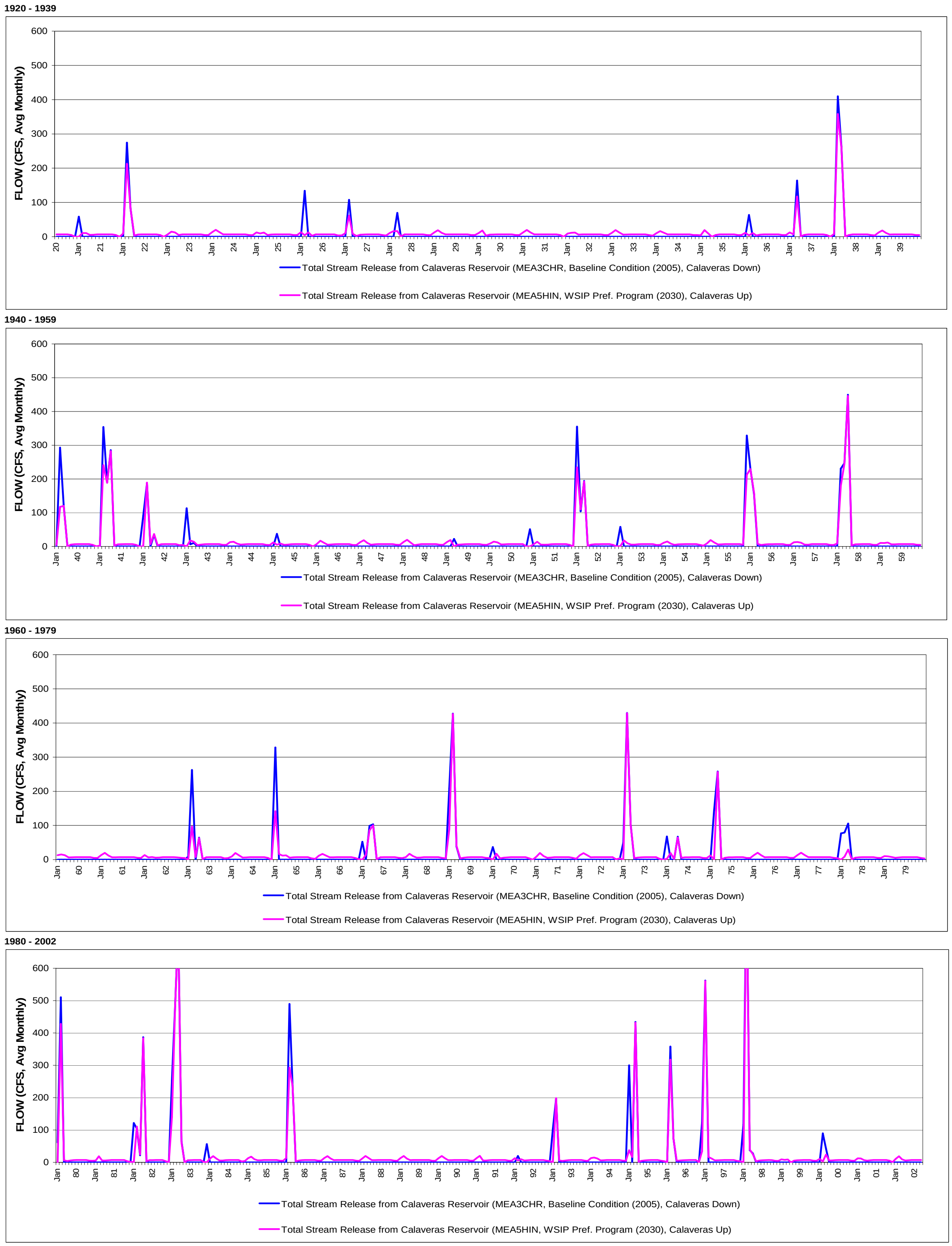
imposes absolute rules, whereas under actual conditions, the SFPUC operators must adjust operations in response to many real-time factors.

Figure 5.4.1-6 presents the estimated change in average monthly reservoir water surface elevation under existing conditions and after implementation of the WSIP. This figure assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam; this represents a worst-case condition for the range of fluctuation in Calaveras Reservoir water levels. The water level in Calaveras Reservoir would be higher year-round with the WSIP; the increase in average monthly storage would be mostly attributable to completion of the Calaveras Dam project (SV-2) and the removal of the DSOD storage limitations. During rainy months, the reservoir water level would be kept near the wintertime storage objective, or roughly 20 to 30 feet higher than under existing conditions. The average water surface elevation would be substantially greater than under current conditions, but only 6 to 12 feet higher than pre-2002 conditions (prior to the DSOD restrictions).

With implementation of the WSIP, the change in operation of Calaveras Reservoir storage would affect hydrologic conditions elsewhere in the watershed. As described below, the restored capacity of Calaveras Reservoir would affect the operation of the Alameda Creek Diversion Dam and Tunnel, and thus the inflow to Calaveras Reservoir and flow to Alameda Creek below the diversion dam. The proposed bypass structure at the Alameda Creek Diversion Dam and the restored storage capacity would also allow for implementation of the 1997 MOU-required releases from either the new bypass structure or Calaveras Reservoir in support of fisheries.

Compared to existing conditions, the WSIP would change the nature of releases from Calaveras Reservoir to Calaveras Creek. With implementation of the fishery releases from the new bypass flow structure at the diversion dam and from Calaveras Reservoir (up to 6,300 afy), there would at times be releases from the reservoir under the WSIP that are not made under existing conditions. These flows would be gaged and maintained below the confluence of Alameda and Calaveras Creeks. Contributing to these flows would be: (1) flows that spill past the Alameda Creek Diversion Dam, (2) unregulated runoff from accretions (inflow) between the diversion dam and the Calaveras Creek confluence, (3) unregulated runoff between Calaveras Dam and the confluence, (4) operational releases from Calaveras Reservoir for reservoir regulation purposes, and (5) operational releases from the Alameda Creek Diversion Dam to support fishery releases when there is available flow in Alameda Creek.

Figure 5.4.1-7 illustrates the modeled chronological releases of water below Calaveras Dam to Calaveras Creek for both existing conditions and with the WSIP; this figure assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam. Operational releases from Calaveras Reservoir occur in about 50 percent of the years under the modeled existing condition and in about 35 percent of the years under the WSIP (with the exception of 1997 MOU releases, which would occur in all years), with most of these years being classified as above-normal or wet. **Table 5.4.1-7** shows the releases from the reservoir for various representative hydrologic year types and assumes the SFPUC would make fishery releases in compliance with the 1997 MOU from Calaveras Reservoir only and does not account for the proposed bypass flows from the diversion dam. As shown in the table, releases with the WSIP would be substantially diminished in the winter months of normal, above-normal, and wet years, with up to a 70 percent reduction. This reduction in the frequency and magnitude of releases would primarily result from removal of the DSOD storage constraint following construction of the Calaveras Dam project (SV-2). With greater operational capacity, more local runoff would be stored and used for water supply. During all months of below-normal and dry years and the majority of months in normal, above-normal, and wet years, the volume of releases would remain nearly the same or would be slightly diminished with the WSIP compared to existing conditions. However, in several scenarios, releases would be eliminated under WSIP operations.



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-7
Chronological Modeled Releases of Water Below Calaveras Dam

TABLE 5.4.1-7
ESTIMATED AVERAGE MONTHLY RELEASES FROM CALAVERAS RESERVOIR TO CALAVERAS CREEK
(cubic feet per second)

Existing Condition (2005 Operations and Facilities)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	28	3	4	0	0	7
Jan	150	44	6	0	0	40
Feb	297	105	16	0	0	83
Mar	162	50	6	0	0	43
Apr	84	8	0	0	0	18
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0

WSIP (2030)

	Wet	Above Normal	Normal	Below Normal	Dry	All
Oct	7	7	7	7	7	7
Nov	4	4	5	5	5	5
Dec	17	3	3	4	5	6
Jan	83	13	9	11	13	25
Feb	270	65	13	16	19	76
Mar	163	46	9	10	12	48
Apr	85	11	4	6	6	22
May	4	5	6	6	7	6
June	7	7	7	7	7	7
July	7	7	7	7	7	7
Aug	7	7	7	7	7	7
Sept	7	7	7	7	7	7

Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)

	Wet		Above Normal		Normal		Below Normal		Dry		All	
Oct	7	*	7	*	7	*	7	*	7	*	7	*
Nov	4	*	4	*	5	*	5	*	5	*	5	*
Dec	-11	-[39%]	0	[0%]	-1	-[25%]	4	*	5	*	-1	-[14%]
Jan	-67	-[45%]	-31	-[70%]	3	[50%]	11	*	13	*	-15	-[38%]
Feb	-27	-[9%]	-40	-[38%]	-3	-[19%]	16	*	19	*	-7	-[8%]
Mar	1	[1%]	-4	-[8%]	3	[50%]	10	*	12	*	5	[12%]
Apr	1	[1%]	3	[38%]	4	*	6	*	6	*	4	[22%]
May	4	*	5	*	6	*	6	*	7	*	6	*
June	7	*	7	*	7	*	7	*	7	*	7	*
July	7	*	7	*	7	*	7	*	7	*	7	*
Aug	7	*	7	*	7	*	7	*	7	*	7	*
Sept	7	*	7	*	7	*	7	*	7	*	7	*

* Indicates a release under the "WSIP (2030)" condition where no release under "Existing Condition (2005)" currently exists.

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
- > 0%
- < 0 to -5%
- < -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

With implementation of the WSIP, summer base flows (flows that occur in the absence of any recent rainfall) in Calaveras Creek below the dam would increase due to the required fishery releases below Calaveras Dam (shown in Table 5.4.1-5). The maximum supplemental release of 6,300 afy might not be needed in every year due to other flows reaching the confluence, including bypass flows at the Alameda Creek Diversion Dam.

Impact Conclusions

As indicated in the relevant tables and figures, the WSIP would substantially reduce average flows in Calaveras Creek below Calaveras Dam in the winter and early spring months of wet and above-normal precipitation years. The proposed program would also increase flows due to fishery releases in the summer months. As indicated on Figure 5.4.1-7, the changes in flow due to the WSIP would occur in years with above-normal rainfall only, and the reduced winter flows would still remain in the range of existing flows; therefore, the impact would be *less than significant*, and no mitigation measures would be required. The new summer instream releases in Calaveras Creek would constitute a beneficial flow impact.

Impact 5.4.1-2: Effects on flow along Alameda Creek below the diversion dam.

The diversion of flows from Alameda Creek at the diversion dam affects two reaches of the creek: the reach between the diversion dam and the confluence with Calaveras Creek and the reach below the confluence with Calaveras Creek. Both reaches are discussed in this impact analysis.

Between the Diversion Dam and the Calaveras Creek Confluence

The Alameda Creek Diversion Dam and Tunnel divert water from the upper Alameda Creek watershed to Calaveras Reservoir. Inflow at the diversion dam is diverted into the tunnel up to the maximum capacity of the tunnel, which is estimated at about 650 cfs. Inflow to the diversion dam that exceeds the tunnel capacity (or when the tunnel gates are closed) flows past the diversion dam and continues downstream in Alameda Creek. As described above, diversions from Alameda Creek to Calaveras Reservoir have been substantially reduced because of the DSOD restrictions on Calaveras Reservoir. Currently, as indicated on Figure 5.4.1-3, Calaveras Reservoir is often filled near, or above, the maximum permitted storage level with runoff from its natural drainage and, at these times, has no capacity to accept diversions from Alameda Creek. Therefore, while the DSOD restrictions on Calaveras Dam are in effect, the SFPUC is unable to capture most local watershed runoff from upper Alameda Creek, and post-2002 flows in Alameda Creek below the diversion dam have been substantially greater than they were prior to 2002.

Modeling of future operations under the WSIP indicates that diversions would primarily occur during the December through May rainy season. The greatest diverted/reduced stream flow quantities would occur from December through March. **Figure 5.4.1-8** shows the modeled chronological average monthly spill of water past the diversion dam for the period from 1920 to 2002. As illustrated in the figure, the number of occurrences and magnitude of flows continuing down Alameda Creek past the diversion dam would be reduced with the WSIP due to more

SOURCE: SFPUC, HH/LSM (see Appendix H).

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Figure 5.4.1-8
Flows in Alameda Creek Below the Diversion Dam

frequent diversions to Calaveras Reservoir. Flows past the diversion dam would be reduced in wet, above normal, and normal year types, although when flow is available, the SFPUC would allow for minimum bypass flows consistent with the requirements of the 1997 CDFG MOU.

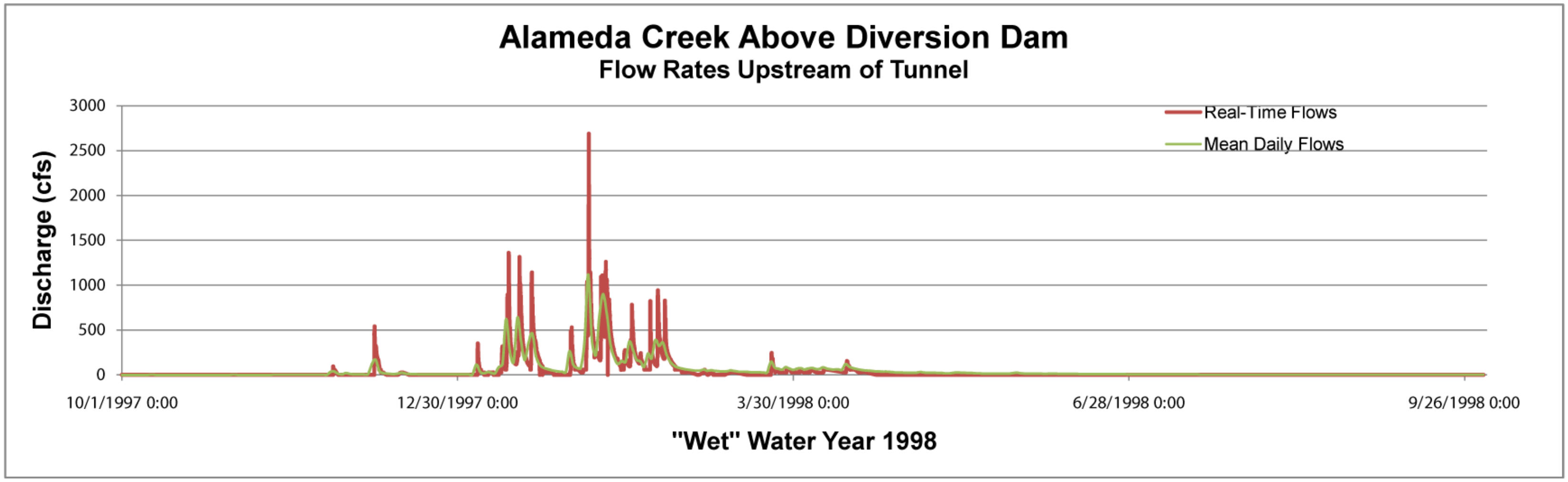
As described in Section 5.4.1.1, Setting, instantaneous gage data (15-minute readings) for the period from 1997 through 2007 indicate that flows greater than 650 cfs in Alameda Creek above the diversion dam have occurred an average of about four days per year (a total of 48 days over the 11-year period) and, in one-quarter of those years, did not occur at all. These instantaneous readings show that flows in excess of 650 cfs occur more frequently than is indicated by the daily mean flow data shown in Table 5.4.1-4. This is because many of the peak flows last for a few hours only and are obscured by 24-hour means. Daily means also underrepresent the actual volumes of water passing the diversion dam. As indicated in **Figures 5.4.1-9** and **5.4.1-10**, under the WSIP in a typical above-normal rainfall year, there would be only a few days per year when flows above the minimal seepage levels (approximately 1 cfs) would reach Alameda Creek below the diversion dam (the primary exceptions being when Calaveras Reservoir is full and diversions cease, and when large storms result in runoff substantially over 650 cfs). However, as indicated on these graphs, substantial volumes of water (sometimes over 1,000 cfs) would still flow down the creek during these peak events. The existing diversion dam facilities seep, and therefore, summer and fall base flows of less than about 1 cfs continue down the creek and these flows would be expected to continue down the creek under the WSIP via the new bypass facilities.

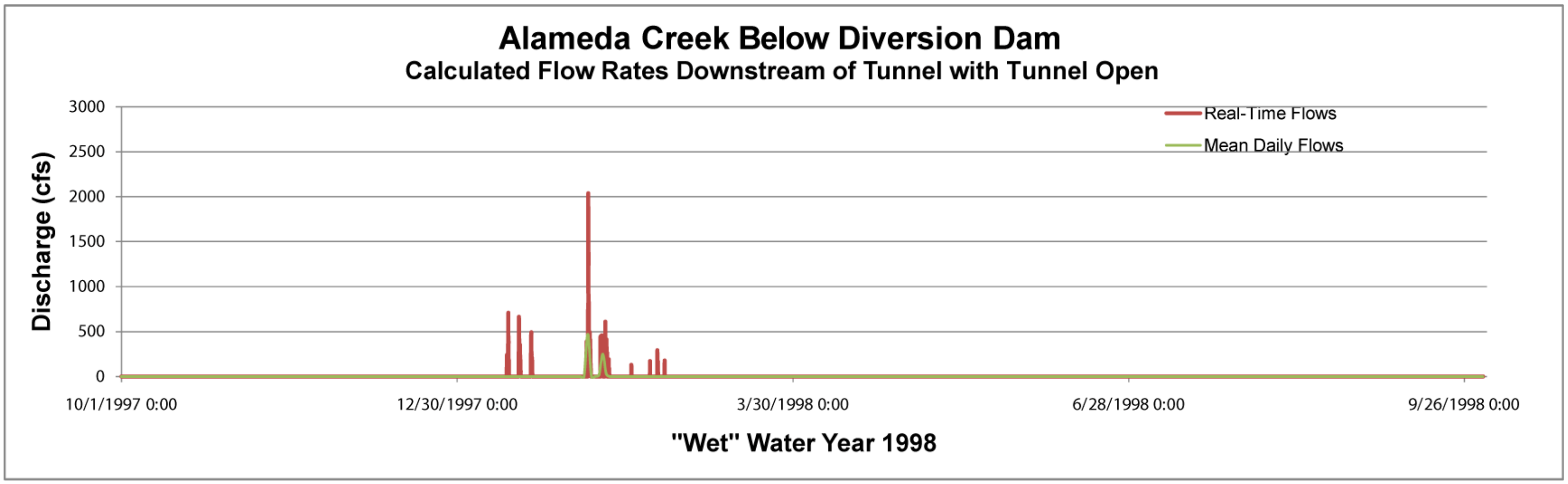
On a storm-by-storm basis, even when stream flows exceed 650 cfs, WSIP diversions would substantially reduce the flows and alter the hydrograph, leaving only brief periods of high flows in major storm events, as shown on Figures 5.4.1-5 and **5.4.1-11**. The graphs show that flows below 650 cfs (which make up several hours of the typical large storm) would be eliminated, and that flows above 650 cfs would be substantially reduced in all but the heaviest storms compared to existing conditions. Both duration and magnitude of flows in the creek downstream of the diversion dam would be substantially reduced during storm events such that, with the proposed program, flows from major storms would resemble those currently occurring during much smaller storm events, and smaller storms would not result in any flows at all.

Alameda Creek Below the Calaveras Creek Confluence

The total flow at the confluence of Alameda and Calaveras Creeks is the combination of total releases/spills from Calaveras Dam, flow spilled past the Alameda Creek Diversion Dam, and the unregulated runoff occurring between the confluence and the diversion dam and Calaveras Dam. However, because most of the flows from Arroyo Hondo and Calaveras Creek are retained in Calaveras Reservoir for water supply storage, the vast majority of Alameda Creek flows in this reach originate above the diversion dam (except when Calaveras spills or makes large releases). This is shown on **Figure 5.4.1-12**, which compares graphs of flows in Alameda Creek in an above-normal year, as gaged above the diversion dam, and below the Calaveras Creek confluence. The graphs indicate that, with the exception of one spike (which may be due to releases from Calaveras Reservoir or an erroneous gage reading), flows above the diversion dam were very similar to those measured just below the Calaveras confluence.

Table 5.4.1-8 presents modeled flow data for the Calaveras confluence in terms of the monthly average flow within year type. As shown in the table, there would be a substantial reduction (up





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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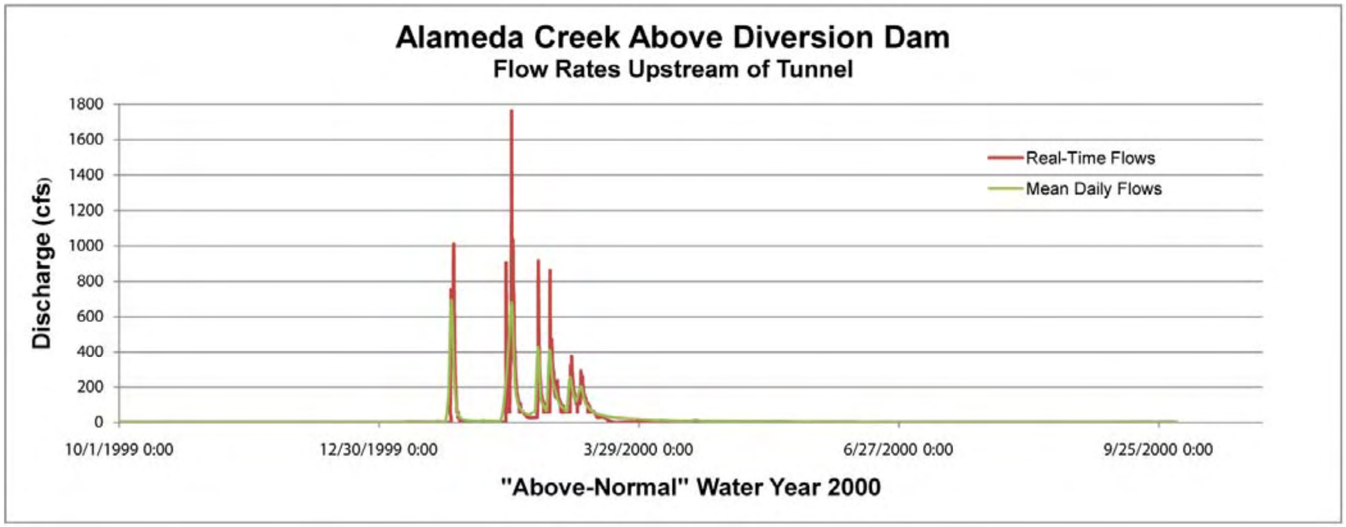
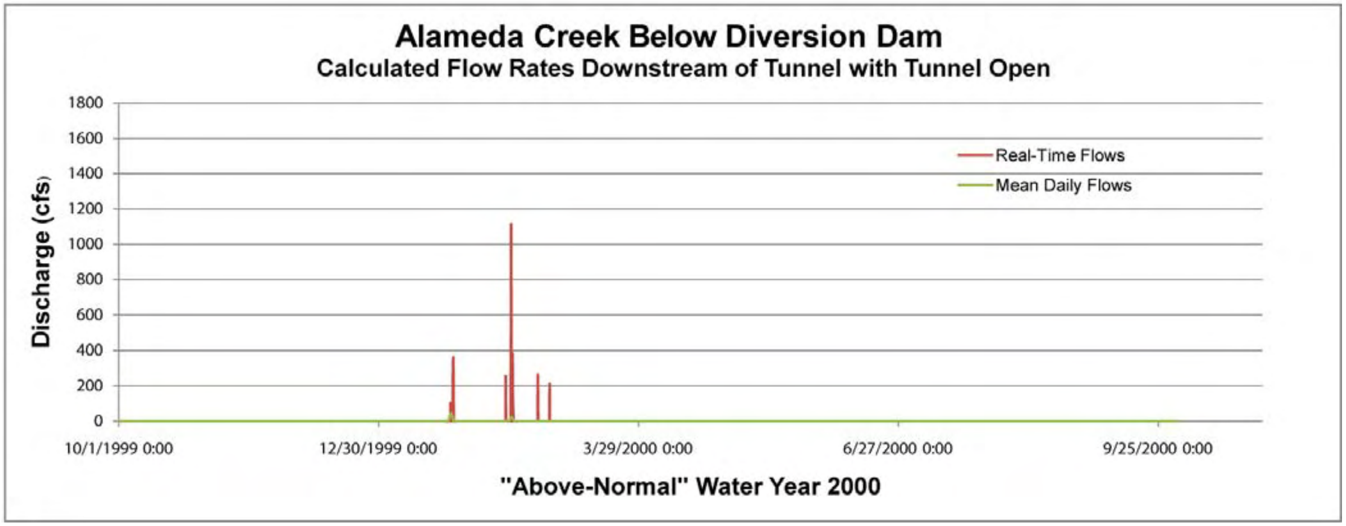
Figure 5.4.1-9
Alameda Creek Above and Below the Diversion Dam –
Flow Rates Upstream and Downstream of the Diversion Tunnel During "Wet" Water Years





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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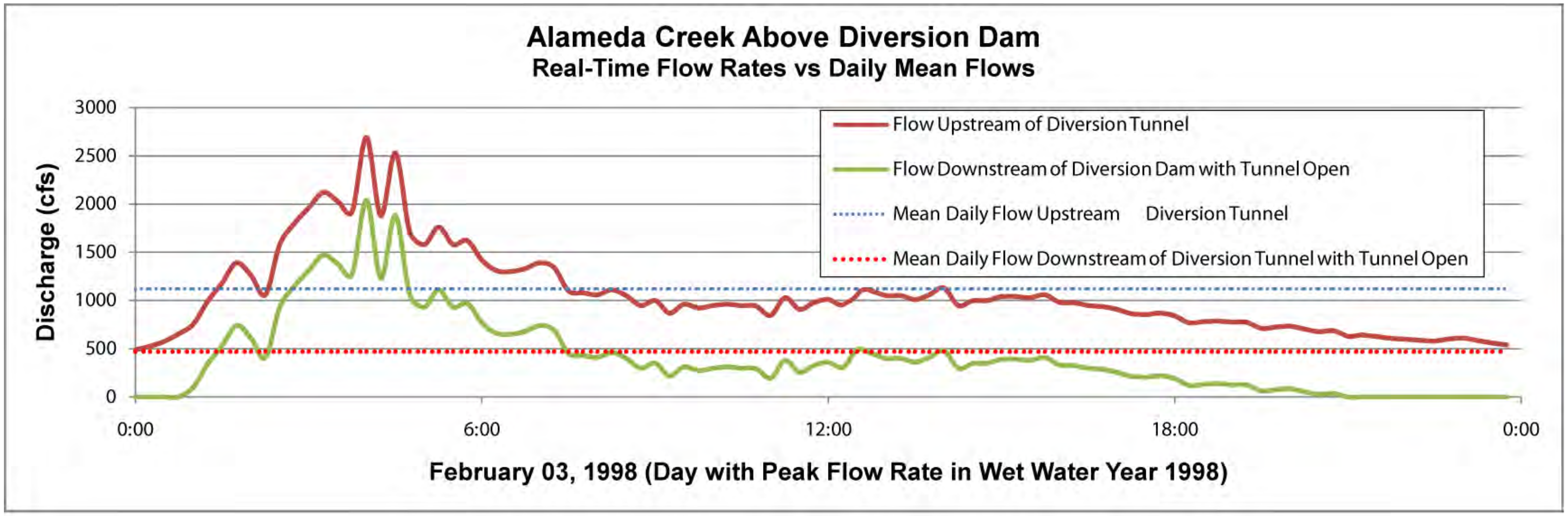
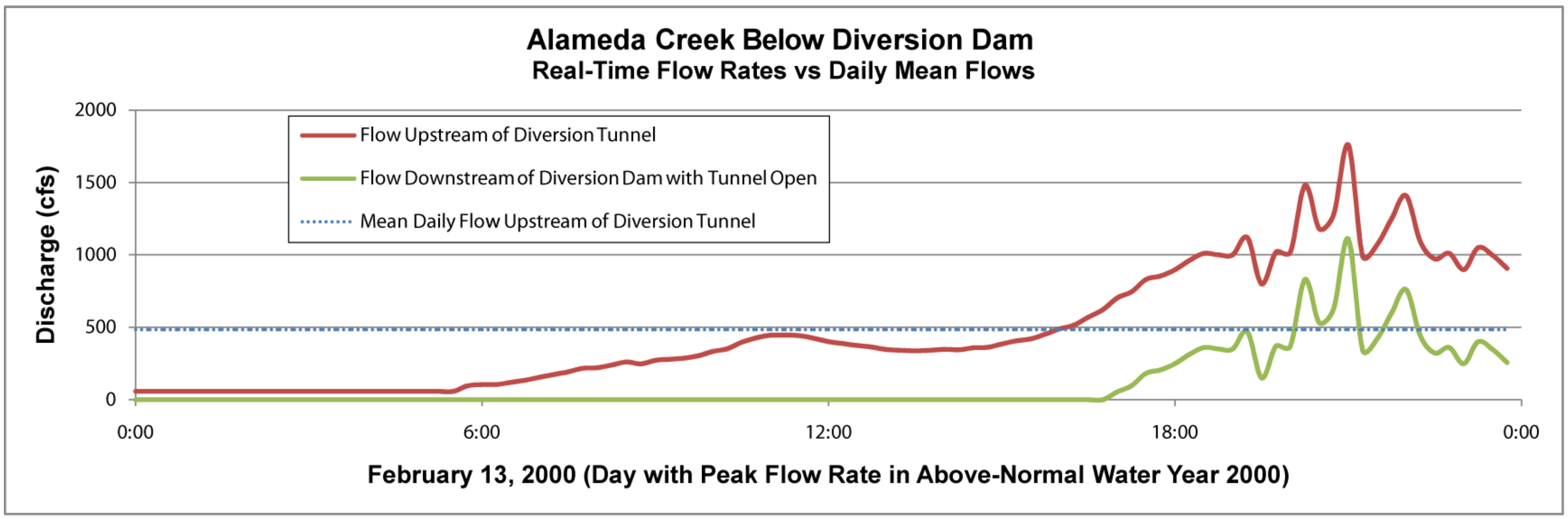
Figure 5.4.1-10
Alameda Creek Above and Below the Diversion Dam –
Flow Rates Upstream and Downstream of Tunnel During “Above-Normal” Water Years





Upper graphic – SOURCE: USGS, 2005b
Lower graphic – SOURCE: USGS, 2005c

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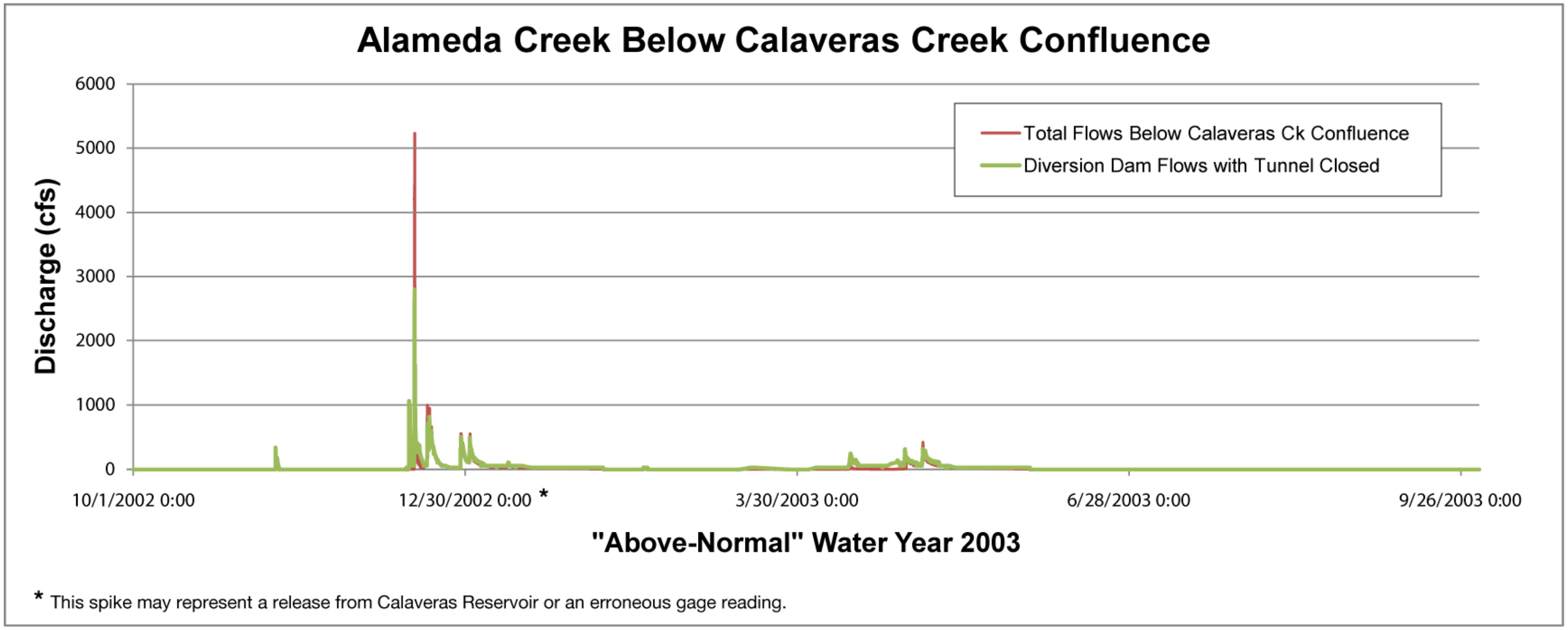
Figure 5.4.1-11
Alameda Creek Above and Below the Diversion Dam –
Real-Time Flow Rates vs Daily Mean Flows



SOURCE: USGS, 2005d

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Figure 5.4.1-12
Alameda Creek Below the Calaveras Creek Confluence

TABLE 5.4.1-8
ESTIMATED AVERAGE MONTHLY FLOW IN
ALAMEDA CREEK BELOW THE CALAVERAS CREEK CONFLUENCE
(cubic feet per second)

	Wet	**Above Normal**	**Normal**	**Below Normal**	**Dry**	**All**
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	1	1	0	0	0	1
Dec	56	26	22	1	1	21
Jan	280	114	24	3	1	84
Feb	463	214	55	6	4	147
Mar	272	110	26	7	1	82
Apr	144	25	5	1	1	35
May	5	2	1	1	0	2
Jun	1	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
WSIP (2030)						
Oct	7	7	7	7	7	7
Nov	5	5	5	5	5	5
Dec	45	18	13	5	5	17
Jan	199	64	18	14	13	61
Feb	434	151	36	22	23	132
Mar	272	106	22	16	13	85
Apr	145	32	9	7	7	40
May	9	7	7	7	7	7
Jun	7	7	7	7	7	7
Jul	7	7	7	7	7	7
Aug	7	7	7	7	7	7
Sep	7	7	7	7	7	7

Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)

	Wet		**Above Normal**		**Normal**		**Below Normal**		**Dry**		**All**	
Oct	7	*	7	*	7	*	7	*	7	*	7	*
Nov	4	[400%]	4	[400%]	5	*	5	*	5	*	4	[400%]
Dec	-11	-[20%]	-8	-[31%]	-9	-[41%]	4	[400%]	4	[400%]	-4	-[19%]
Jan	-81	-[29%]	-50	-[44%]	-6	-[25%]	11	[367%]	12	[1,200%]	-23	-[27%]
Feb	-29	-[6%]	-63	-[29%]	-19	-[35%]	16	[267%]	19	[475%]	-15	-[10%]
Mar	0	[0%]	-4	-[4%]	-4	-[15%]	9	[129%]	12	[1,200%]	3	[4%]
Apr	1	[1%]	7	[28%]	4	[80%]	6	[600%]	6	[600%]	5	[14%]
May	4	[80%]	5	[250%]	6	[600%]	6	[600%]	7	*	5	[250%]
June	6	[600%]	7	*	7	*	7	*	7	*	7	*
July	7	*	7	*	7	*	7	*	7	*	7	*
Aug	7	*	7	*	7	*	7	*	7	*	7	*
Sept	7	*	7	*	7	*	7	*	7	*	7	*

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key:

* Indicates a release under the "WSIP (2030)" condition where no release under "Current Condition (2005) currently exists.

(cyan)	> 0%
(yellow)	< 0 to -5%
(orange)	< -5%

SOURCE: SFPUC, HH/LSM (See Appendix H)

to 44 percent) in wintertime flow at the confluence during normal, above-normal and wet years. As with the upstream reach, peak flows would also be substantially reduced, primarily as a result of renewed upstream diversions. However, overall flows would be increased due to fishery releases.

Figure 5.4.1-13 illustrates the modeled chronological stream flows at the confluence for both the existing condition and with the WSIP. As shown in the figure, flow is low in many years under both existing and WSIP conditions, with rapid spikes in flow during and immediately following episodes of high rainfall. However, except in times of spills or winter releases from Calaveras Reservoir, winter and early spring flows in Alameda Creek at Calaveras Creek would be substantially reduced due to the reinstated large-scale diversions from Alameda Creek (described above). As shown in Figure 5.4.1-11, although the effects of reduced diversions would occasionally be damped by releases from Calaveras Reservoir, renewed diversions would continue to substantially reduce rainy season flows in Alameda Creek at and below its confluence with Calaveras Creek.

Under the WSIP, the SFPUC would augment flow below the confluence of Calaveras and Alameda Creeks by bypassing/releasing water from the Alameda Creek Diversion Dam and Calaveras Reservoir; as a result, there would be an increase in flow at the confluence in April to November of wet and above-normal rainfall years and in all instances of other years. The target flow rates in Alameda Creek are shown in **Table 5.4.1-9**. The proposed program includes facilities (as part of the Calaveras Dam project, SV-2) to provide the 1997 MOU-required releases. In addition, the SFPUC is developing alternative means of recapturing a portion of the water released downstream of the Sunol Valley WTP as part of the Alameda Creek Fishery project (SV-1).

TABLE 5.4.1-9
MINIMUM FLOWS BELOW THE CONFLUENCE OF ALAMEDA AND CALAVERAS CREEKS

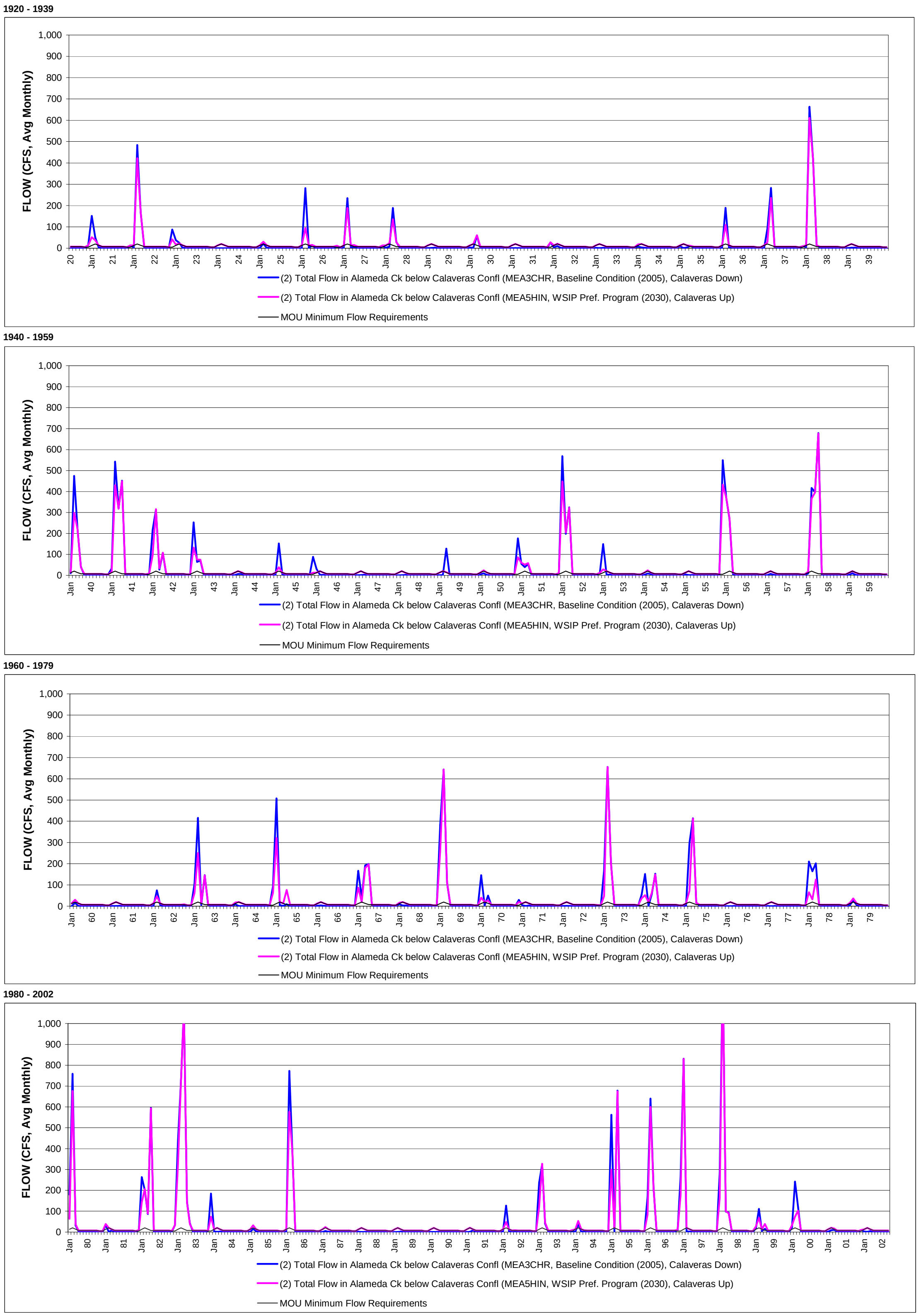
Period	5-Day Running Average (cfs)	Minimum Daily (cfs)
November 1 – January 14	5	4.5
January 15 – March 15	20	18
March 16 – October 31	7	6.3

cfs = cubic feet per second

SOURCE: CDFG, 1997.

Impact Conclusions

Implementation of the WSIP would increase diversions from Alameda Creek to Calaveras Reservoir, nearly eliminating the low and moderate (1 to 650 cfs) flows in Alameda Creek downstream of the diversion dam that currently occur when the diversion gates are closed, and substantially reducing many higher (greater than 650 cfs) flows. Under the WSIP, flows in Alameda Creek in the reach below the diversion dam to the Calaveras Creek confluence and in the reach below the confluence would be substantially reduced compared to the conditions in



SFPUC Water System Improvement Program ▪ 203287

SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-13
Flow in Alameda Creek below the Calaveras Creek Confluence

existence since December 2001, when the DSOD imposed storage capacity restrictions on Calaveras Reservoir. This reduction of stream flows and alteration of the stream hydrograph is considered a substantial hydrologic effect and, as a result, this impact is *significant and unavoidable*. Measure 5.4.1-2, Diversion Tunnel Operation, requires the SFPUC to close the diversion dam and cease Alameda Creek diversions to Calaveras Reservoir as soon as possible each year, once the reservoir is at desired levels, such that the later-season storm flows not needed to refill Calaveras Reservoir are allowed to flow down Alameda Creek past the diversion dam to the lower reaches. Although this measure could help reduce the impact, it would not fully mitigate it; therefore, this impact would remain significant and unavoidable for the reaches of Alameda Creek below the diversion dam to its confluence with Calaveras Creek and below the confluence. However, after implementation of the WSIP, flow in this 2.85-mile reach of Alameda Creek would approximate conditions experienced between 1935 and 2001. In addition, in some years, flows in Alameda Creek below the diversion dam would be greater due to revised reservoir operations. The reestablishment of the diversions is necessary to achieve the SFPUC water supply objectives, and full mitigation could not be accomplished without foregoing the needed diversions.

This impact conclusion applies only to flow effects and not to the indirect impacts associated with these flow changes. Indirect effects are addressed in subsequent sections of this chapter; as discussed, these effects are either less than significant, or mitigation has been identified to reduce them to a less-than-significant level.

As a result of the 2001 DSOD restriction on Calaveras Reservoir, the SFPUC has had to reduce the volume of water stored in Calaveras and has therefore significantly reduced its diversions through the Alameda Creek Diversion Dam by closing the tunnel more frequently compared to its 70-year historic operation. Upon completion of the Calaveras Dam Replacement project (SV-2), the SFPUC would no longer have DSOD restrictions on storage levels in Calaveras Reservoir. Compared to historical operations with full storage capacity at Calaveras, the SFPUC plans to maintain Calaveras Reservoir at a higher elevation over longer periods of time, and as a result the Alameda Creek Diversion Tunnel would be closed more often than historically and there would be more occasions when water bypasses the diversion dam into Alameda Creek (see Appendix H2-2, Table 2.7-7). Therefore, in the reach below the confluence with Calaveras Creek, the increased dry-season releases that would occur under the WSIP in accordance with the 1997 MOU would be a beneficial effect.

Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek.

The overall operation of San Antonio Reservoir with the WSIP would remain the same as under existing conditions. San Antonio Reservoir would continue to be operated to conserve local watershed runoff for integration into the SFPUC water supply and, when possible, would continue to store imported water from the Hetch Hetchy system to maximize carryover storage. As described below, the HH/LSM indicates small changes in reservoir releases; however, those changes are within the range of operator discretion, and actual operations may be closer to existing operations.

Figure 5.4.1-14 illustrates the modeled chronological operation of San Antonio Reservoir for both the existing condition and with the WSIP. The figure shows the reservoir's storage, inflow from the Hetch Hetchy system, and releases to San Antonio Creek for each condition.

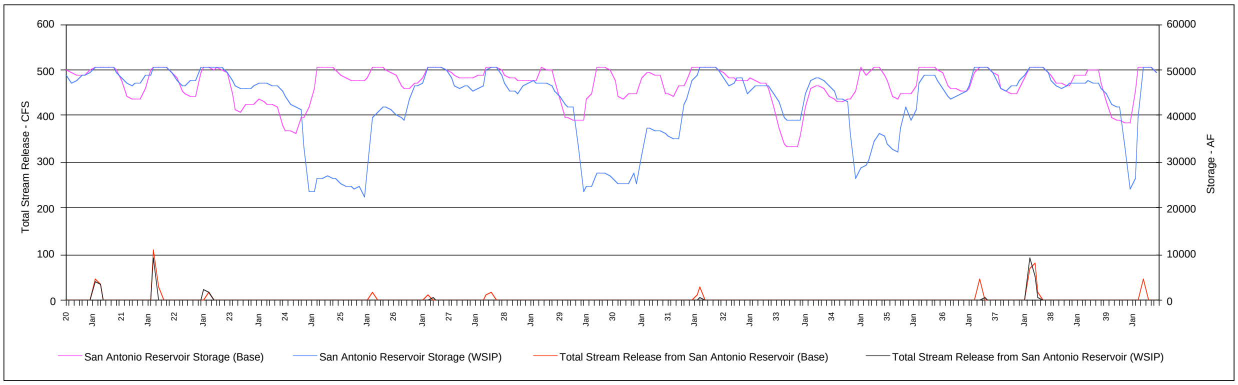
WSIP operations involve keeping local reservoirs higher for delivery reliability and system maintenance purposes. This supply would be used to maintain the Sunol Valley WTP's minimum throughput of 20 mgd and to satisfy water demand in excess of Hetch Hetchy flows. Every fifth year storage levels would drop when planned maintenance for the Mountain Tunnel would reduce Hetch Hetchy flows to the Bay Area during the winter. During this period, San Antonio Reservoir would be drawn to replace the flows not provided from the Hetch Hetchy system. The reservoir would refill to typical operating levels within one to two years after the maintenance period.

The change in operation of San Antonio Reservoir storage would result in minor changes to other components of watershed hydrology. As described below, the increased storage in San Antonio Reservoir would affect the operation of diversions to the Sunol Valley WTP and imports from Hetch Hetchy. The increased storage capacity would also affect the release of spills from San Antonio Reservoir and subsequently the downstream flows in Alameda Creek.

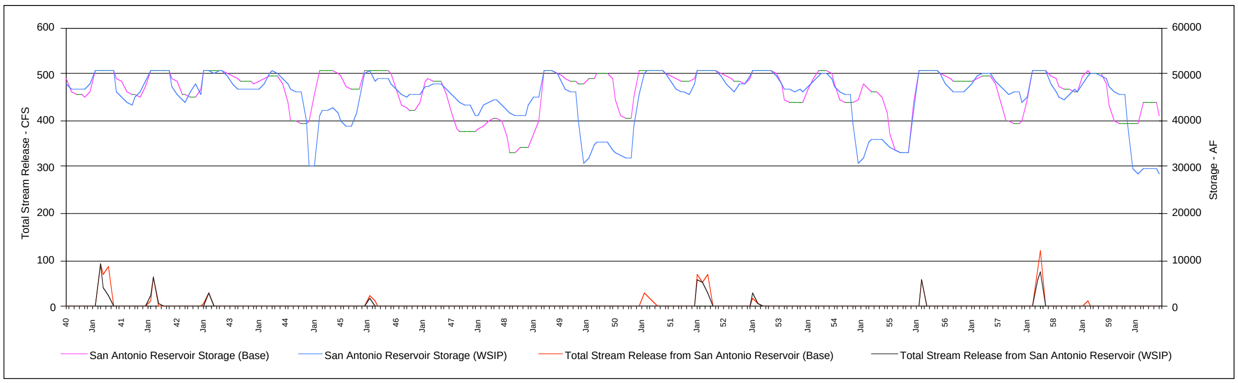
As indicated in the table, the WSIP would have a minimal effect on flow in San Antonio Creek. The proposed program would result in minor increases and decreases in winter and spring flows in some above-normal years. Occasionally, the WSIP could result in spills to San Antonio Creek that would not occur under existing conditions.

Figure 5.4.1-15 illustrates the modeled chronological release of water below Turner Dam under the existing condition and with the WSIP. Releases from San Antonio Reservoir to San Antonio Creek have historically been rare and would continue to be rare with the WSIP. Releases past the dam are modeled to occur at about the same frequency with the WSIP—mostly in above-normal or wet years. It should be noted that under actual operations, these changes in modeled average monthly flows could take the form of a few days of larger releases.

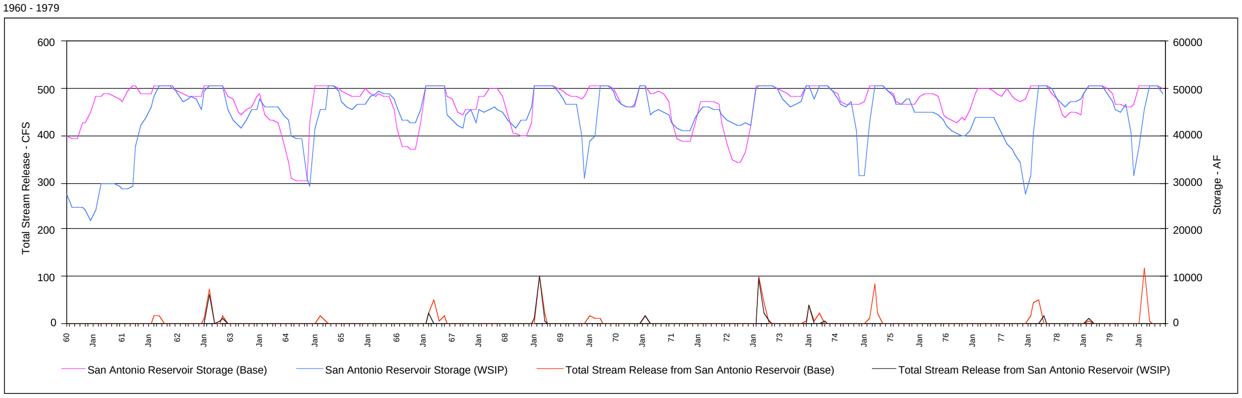
1920 - 1939



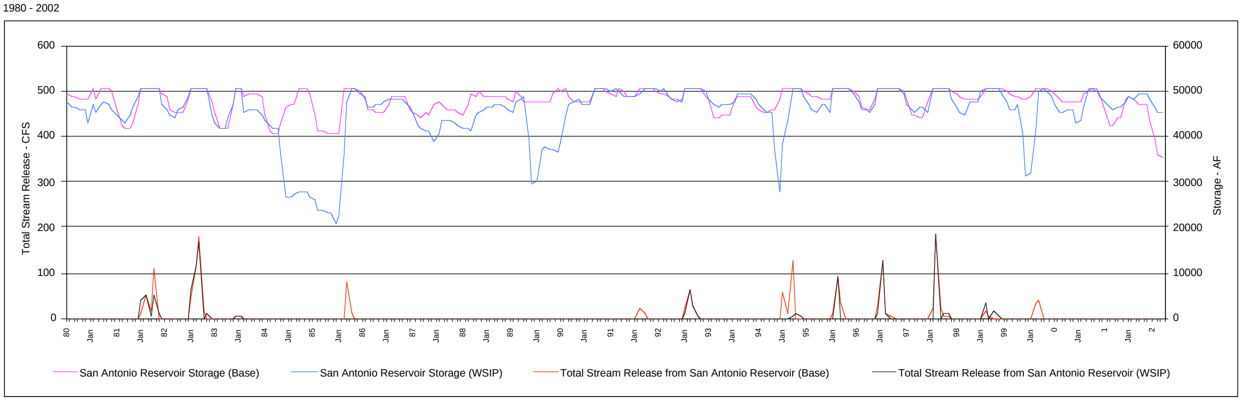
1940 - 1959



1960 - 1979



1980 - 2002



Note: This figure is revised to reflect updated HH/LSM modeling (see Appendix O).

SOURCE: SFPUC, HH/LSM

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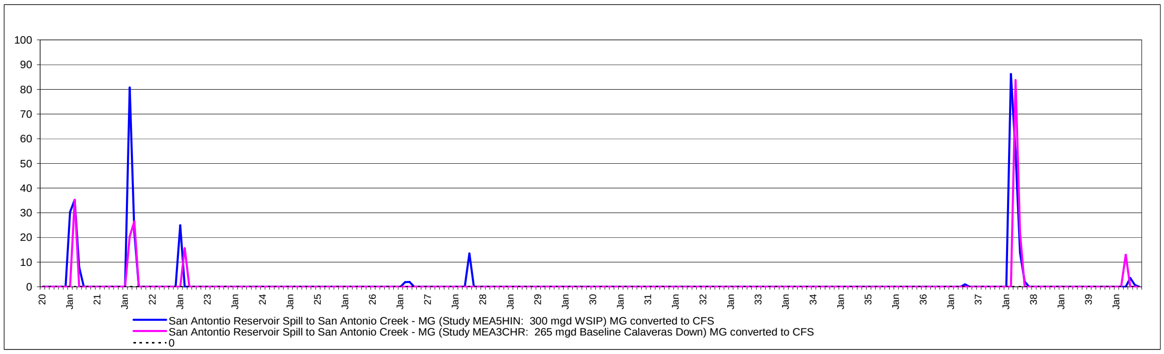
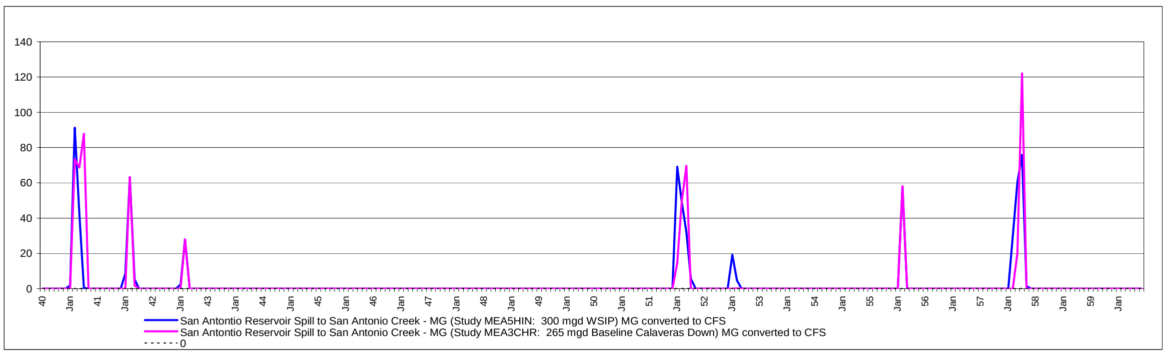
Figure 5.4.1-14 (Revised)
Chronological Operation of San Antonio Reservoir

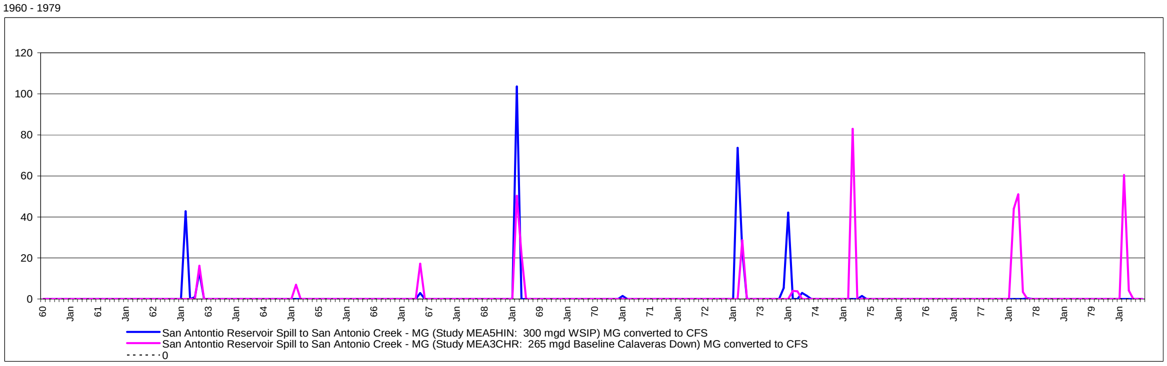
1920 - 1939



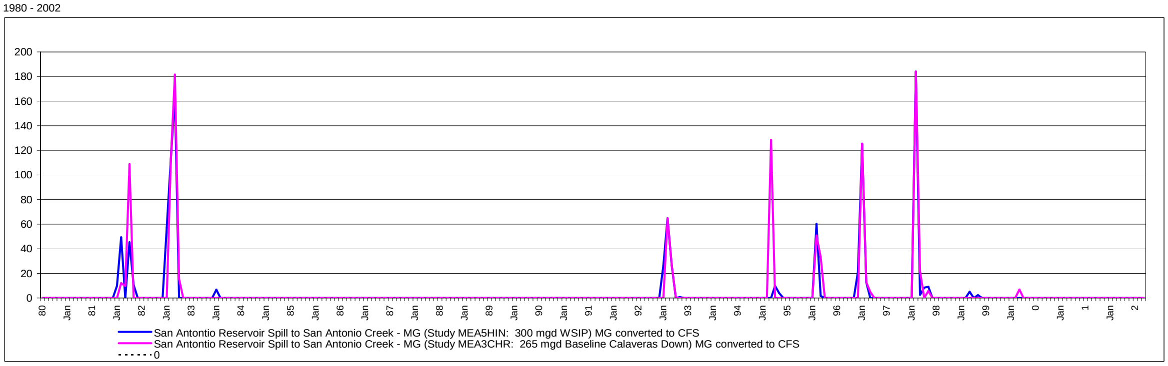
1940 - 1959



1960 - 1979



1980 - 2002



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SOURCE: SFPUC, HH/LSM (see Appendix H).

Figure 5.4.1-15
San Antonio Reservoir Releases to San Antonio Creek

Table 5.4.1-10 presents the modeled average monthly releases from San Antonio Reservoir under the existing condition and with the WSIP. The table also shows the difference in flow between the existing and WSIP conditions. Differences in releases could occur during the rainy season; the magnitude of the differences varies greatly compared to modeled existing flows, sometimes increasing and sometimes decreasing. Although the model predicts small releases in wet months, in reality the projected releases of less than an average monthly flow of 35 cfs (2,000 acre-feet) could likely be avoided through flexibility in actual day-to-day operations that cannot be represented by the HH/LSM (meaning that there would have been no flow released under those circumstances).

Impact Conclusions

Because the modeled flow changes in San Antonio Creek are within the current range and would be quite small, this impact would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.1-4: Effects on flow along Alameda Creek below the confluence of San Antonio Creek.

The flow at the confluence of Alameda and San Antonio Creeks is a function of: (1) flows arriving at the confluence of Alameda and Calaveras Creeks, which are dependent on releases from Calaveras Dam, flow spilled past the Alameda Creek Diversion Dam, and the unregulated runoff occurring between the confluence and the diversion dam and Calaveras Dam, (2) unregulated runoff from the watershed between the two confluences, and (3) flow entering Alameda Creek from San Antonio Creek, which is regulated by releases from Turner Dam. In addition, the creek can seasonally either lose (dry season) or gain (rainy season) flows to and from the groundwater and nearby gravel pits. Depending on its design and location, the recapture facility to be constructed under the Alameda Creek Fishery project (SV-1) could also draw groundwater flows from the creek.

Figure 5.4.1-16 illustrates the modeled flow at the confluence during the various rainfall scenarios for the existing condition and with the WSIP. **Table 5.4.1-11** presents modeled flows at the confluence in terms of the average monthly flow within hydrologic year type. As shown in the figure and table, there would be a substantial (8 to 52 percent) reduction in flow volumes at the confluence during January, February, and March of normal or wetter years, depending on the rainfall distribution. The majority of this effect would occur due to the reduction in spills from Calaveras Reservoir and increased diversions from the Alameda Creek Diversion Dam during these periods. However, in April of normal years, the modeled data indicate a moderate increase in total flow volumes (about 14 percent), again due to the change in operation of Calaveras Reservoir, as described above.

**TABLE 5.4.1-10
ESTIMATED AVERAGE MONTHLY RELEASES FROM
SAN ANTONIO RESERVOIR TO SAN ANTONIO CREEK
(cubic feet per second)**

	Wet	Above Normal	Normal	Below Normal	Dry	All
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Jan	9	0	0	0	0	2
Feb	42	16	0	0	0	11
Mar	40	14	0	0	0	11
Apr	22	0	0	0	0	4
May	1	1	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
WSIP (2030)						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	1	0	0	0	0	0
Jan	17	7	2	0	0	5
Feb	57	18	0	0	0	15
Mar	24	4	0	0	0	5
Apr	10	0	1	0	0	2
May	2	1	0	0	0	1
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0

Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)

	Wet		Above Normal		Normal		Below Normal		Dry		All	
Oct	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Nov	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Dec	1	*	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Jan	8	[89%]	7	*	2	*	0	[0%]	0	[0%]	3	[150%]
Feb	15	[36%]	2	[13%]	0	[0%]	0	[0%]	0	[0%]	4	[36%]
Mar	-16	-[40%]	-10	-[71%]	0	[0%]	0	[0%]	0	[0%]	-6	-[55%]
Apr	-12	-[55%]	0	[0%]	1	*	0	[0%]	0	[0%]	-2	-[50%]
May	1	[100%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	1	*
June	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
July	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Sept	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]

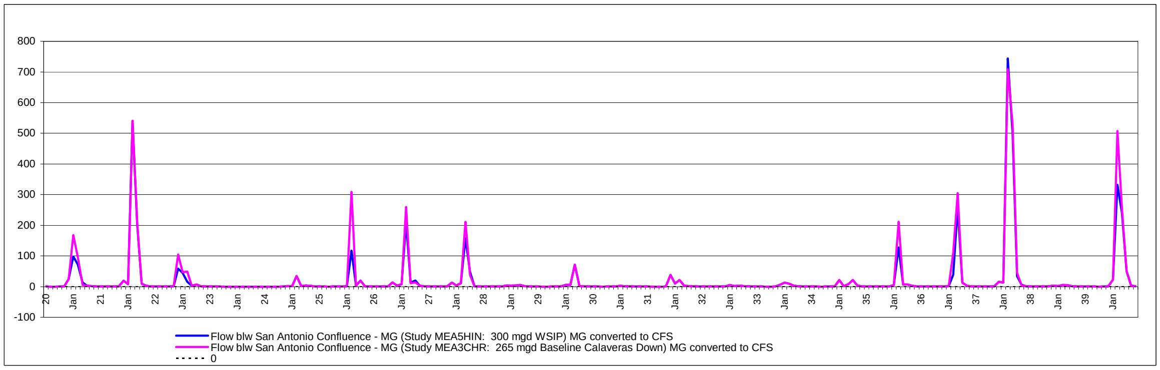
* Indicates a release under the "WSIP (2030)" condition where no release under "Existing Condition (2005)" currently exists.

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

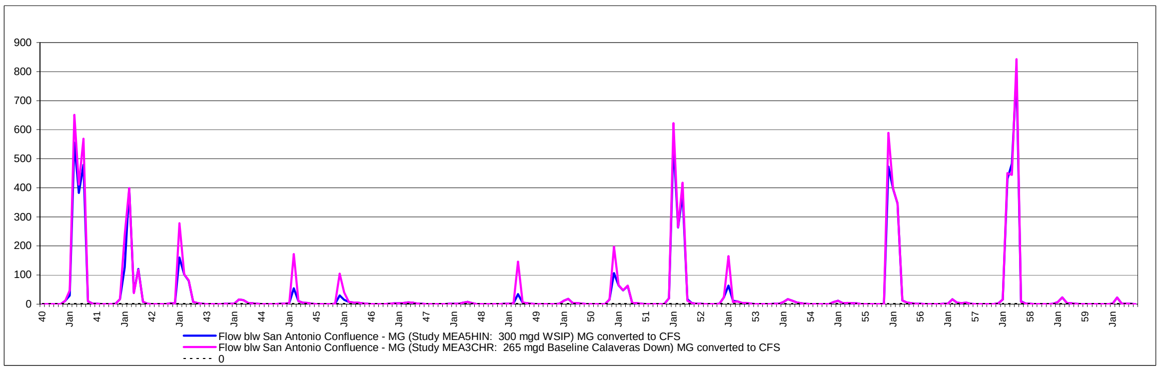
Key
- > 0%
- < 0 to -5%
- < -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

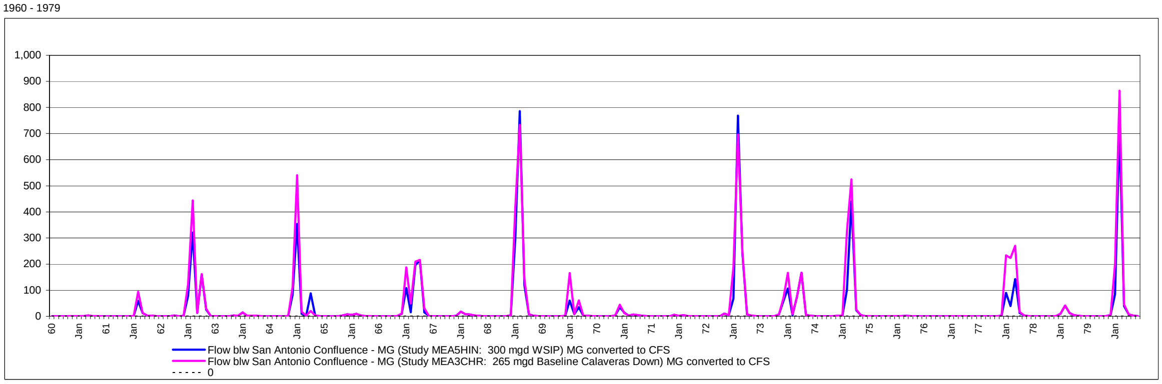
1920 - 1939



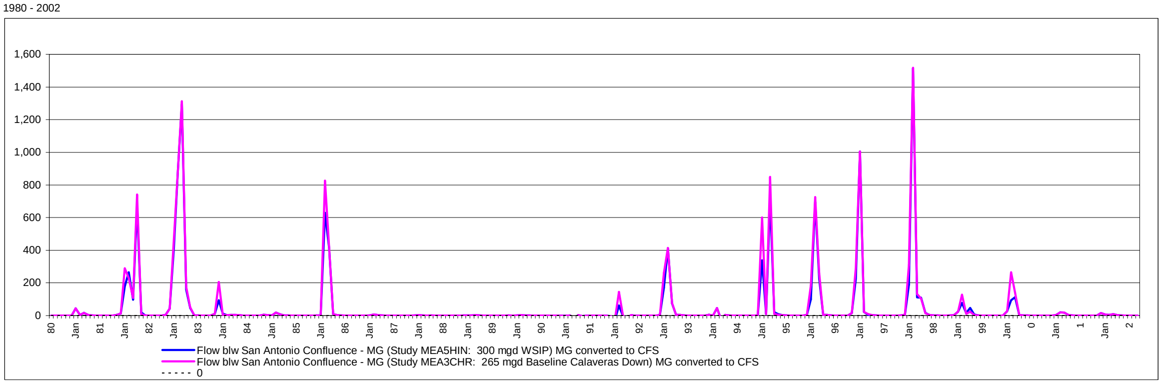
1940 - 1959



1960 - 1979



1980 - 2002



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SOURCE: SFPUC, HH/LSM (see Appendix H)

Figure 5.4.1-16
Chronological Flows in Alameda Creek at the Confluence with San Antonio Creek

TABLE 5.4.1-11
ESTIMATED AVERAGE MONTHLY FLOW IN ALAMEDA CREEK BELOW THE SAN ANTONIO CREEK CONFLUENCE
(cubic feet per second)

	Wet		Above Normal		Normal		Below Normal		Dry		All	
Existing Condition (2005)												
Oct	0		0		0		0		0		0	
Nov	2		2		1		1		0		1	
Dec	61		30		25		2		1		24	
Jan	303		122		28		5		1		91	
Feb	523		242		61		10		5		167	
Mar	326		132		30		10		2		99	
Apr	176		29		7		2		1		42	
May	9		4		2		1		1		3	
June	1		1		0		0		0		0	
July	0		0		0		0		0		0	
Aug	0		0		0		0		0		0	
Sept	0		0		0		0		0		0	
WSIP (2030)												
Oct	0		0		0		0		0		0	
Nov	2		2		1		1		0		1	
Dec	50		19		13		2		1		17	
Jan	229		75		14		5		1		64	
Feb	505		174		29		10		5		143	
Mar	308		113		18		10		2		89	
Apr	162		35		8		2		1		41	
May	9		4		2		1		1		3	
June	1		1		0		0		0		0	
July	0		0		0		0		0		0	
Aug	0		0		0		0		0		0	
Sept	0		0		0		0		0		0	
Difference and Percent Change, Existing Condition (2005) vs WSIP (2030)												
Oct	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Nov	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Dec	-11	-[18%]	-11	-[37%]	-12	-[48%]	0	[0%]	0	[0%]	-7	-[29%]
Jan	-74	-[24%]	-47	-[39%]	-14	-[50%]	0	[0%]	0	[0%]	-27	-[30%]
Feb	-18	-[3%]	-68	-[28%]	-32	-[52%]	0	[0%]	0	[0%]	-24	-[14%]
Mar	-18	-[6%]	-19	-[14%]	-12	-[40%]	0	[0%]	0	[0%]	-10	-[10%]
Apr	-14	-[8%]	6	[21%]	1	[14%]	0	[0%]	0	[0%]	-1	-[2%]
May	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
June	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
July	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Sept	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]

NOTE: "Existing Condition (2005)" is based on model run MEA3CHR. "WSIP (2030)" is based on model run MEA5HIN. An overview of the model runs is presented in Section 5.1. Detailed information on the models and underlying assumptions is provided in Appendix H.

Key
- > 0%
- < 0 to -5%
- < -5%

SOURCE: SFPUC, HH/LSM (see Appendix H).

Impact Conclusions

Flow in Alameda Creek below the confluence of San Antonio Creek would be altered as a result of the WSIP in winter months of normal or wetter years; however, the change in flows would be substantially dampened by inflows from other tributaries in the Sunol Valley and would not result in any adverse hydrologic effects. Therefore, impacts on Alameda Creek below the confluence of San Antonio Creek would be *less than significant*, and no mitigation measures would be required.

There would be no change in flows in most other months of normal or wetter years and in all months of drier years, because the fishery releases would be recaptured at a location upstream from the confluence of Alameda and San Antonio Creeks.

[Additional discussion on flow in lower Alameda Creek was prepared in response to comments on the Draft PEIR. Please refer to Section 14.9, Master Response on Alameda Creek Fishery Issues (Vol. 7, Chapter 14) and to Appendix N, Technical Memorandum—Estimation of Flow Changes in Lower Alameda Creek with Implementation of the WSIP (Vol. 8).]

References – Stream Flow and Reservoir Water Levels

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5.4.2 Geomorphology

The following setting section describes the geomorphology of the streams in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.2.2) provides a description of the changes in stream channel form and erosion that would result from WSIP-induced changes in stream flow, as described in Section 5.4.1.

5.4.2.1 Setting

Geomorphology and Sediment Transport

The SFPUC's Alameda watershed upstream of Niles Canyon is comprised of two general landform (geomorphic) regions: the "canyon areas" above the Sunol Valley WTP, and the Sunol Valley. The geomorphology of the canyon areas can be further divided into reservoirs and stream channels. The fluvial geomorphologic conditions[1] of each of these areas are summarized below.

The Sunol Valley has lower gradients than the canyon reaches, and the channel bed and banks are primarily comprised of sediments. There are several grade controls (where erosion is restricted by a solid feature such as a bedrock outcrop, weir, or dam) in the Sunol Valley and downstream; two of these, Sunol and Niles Dams, were recently lowered by the SFPUC to calculated pre-dam streambed elevations. A bedrock outcrop about 1,000 feet below the Sunol Dam site also controls channel morphology and stream downcutting (Weiss Associates, 2004).

An average of approximately 270,000 tons (160,000 cubic yards) of sediment is transported by Alameda Creek annually. At the Sunol dam site, these sediments are about one-quarter to one-third sand and two-thirds to three-quarters gravel. These sediments are transported by high flows in the creek; for example, it has been estimated that the 3.5-year flow in Alameda Creek at the Sunol Dam site (approximately 7,000 cfs) transports a volume of sediment equal to about 25 percent of the average annual sediment load in the creek (Weiss Associates, 2004). Sediment transport curves developed by Weiss Associates for Alameda Creek near Niles indicate minimal sediment transport with flows of less than 20 cfs, and an increase from 10 to 1,000 tons/day when stream flows increase from 100 to 1,000 cfs. At 2,000 cfs, sediment loads approach 10,000 tons/day. At Niles Canyon, there is virtually no bedload transport[2] with flows under 1,000 cfs, and 2,500 to 6,000 tons/day with flows of 10,000 cfs (Weiss Associates, 2004).

The ACFCWCD removes about 300,000 cubic yards of sediments from their flood control channel downstream of Niles Canyon every 10 years; this constitutes about 19 percent of the total creek sediment load. The remaining sediments deposit in parts of the flood control channel that are not subject to maintenance and/or are eventually transported to San Francisco Bay (Weiss Associates, 2004). It should be noted that these are long-term averages, and annual sediment loads could vary widely depending on runoff events and watershed conditions.

[1] The term "fluvial geomorphologic conditions" refers to changes in the shape of the stream channels and associated erosional and depositional features (e.g., canyons, streambeds, stream banks, floodplains), and the hydrologic and geologic processes and conditions contributing to or affecting those changes.

[2] Bedload refers to the amount of sediment, cobbles, gravel, and rocks transported along the stream bottom (as opposed to suspended in the stream flow).

Much of this sediment is generated in the Vallecitos, Arroyo Mocho, Arroyo Valle, and Arroyo de la Laguna watersheds, outside of the SFPUC watersheds. These watersheds include large alluvial valleys, where erosion due to natural channel meandering as well as land management practices can generate substantial sediment volumes. Although substantial sediment generation can occur from the steep slopes in the upper watersheds (upstream of Calaveras and San Antonio Dams), much of this sediment is trapped behind these dams.

The stream channel portions of the canyon areas include stretches of bedrock channels interspersed with lower gradient areas, such as the Calaveras Valley, where the channel bottom and sides are comprised primarily of sediments. Substantial quantities of sediment have accumulated in Calaveras and San Antonio Reservoirs. In the upstream reach of Alameda Creek, the SFPUC discharges approximately 900 cubic yards per year of sediment accumulated behind the Alameda Creek Diversion Dam via 50-cfs flow releases through the sluice gates. This indicates that, in the narrower, steeper reaches of the creek, smaller flows are adequate to transport accumulated suspended sediments. Such smaller flows may also affect the local geomorphic conditions of the small alluvial flats, banks, and terraces adjacent to the stream channels above Sunol Valley.

5.4.2.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to geomorphology, but generally considers that implementation of the proposed program would have a significant impact if it were to:

- Substantially change the topography such that ecological, hydrologic, or aesthetic functions are adversely affected, or substantially change any unique geologic or physical features of the site or area
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation or adversely affect the ecological, hydrologic, or aesthetic functions of the site or area

Although the "substantial change in topography" criterion is typically applied to upland areas, it is considered applicable to stream channel/bank topography in this instance because of the sensitivity of the resources that depend on the topography of those features (i.e., riparian vegetation and fisheries). For a stream channel, the relevant aspect of topography to be evaluated are those associated with channel form and the related movement and distribution of sediment.

Approach to Analysis

This impact section discusses projected changes in sediment transport and geomorphology, reservoir storage, and related reservoir water levels resulting from WSIP implementation. In addition to potential direct impacts, these sediment transport changes could cause indirect environmental impacts in areas for which the CEQA Guidelines Appendix G identifies significance criteria, including flooding potential, erosion, water quality, fisheries, aquatic and riparian resources and related special-status species, and recreation and visual resources. These potential impacts are addressed in the respective sections of this PEIR.

This assessment of potential effects is based on generalized channel bed/bank characteristics and consideration of proposed changes in stream flow that would result from the WSIP.

Impact Summary

Table 5.4.2-1 presents a summary of the impacts on sediment transport and geomorphology in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.2-1
SUMMARY OF IMPACTS – GEOMORPHOLOGY OF THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek	LS
Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence.	LS
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir	LS

LS = Less than Significant impact, no mitigation required

Impact 5.4.2-1: Effects on channel formation and sediment transport along Calaveras Creek.

There are currently no uncontrolled releases (spills) from Calaveras Reservoir. With the WSIP, uncontrolled releases would occur during heavy rains, particularly later in the rainfall season when the reservoir is full. Therefore, the WSIP could result in increased erosion, sediment transport, and deposition downstream of Calaveras Dam during heavy rainfall events compared to existing conditions. However, these higher flows, and therefore sediment transport, are similar to the long-term conditions that formed the current channel. Therefore, impacts on channel formation and sediment transport along Calaveras Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.2-2: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence.

Increased use of the diversion tunnel under the WSIP would reduce peak flows in Alameda Creek downstream of the diversion dam by up to 650 cfs compared to existing conditions; lesser flows (under 500 to 600 cfs) would also be diverted, which could reduce erosion, sediment transport, and deposition in the channel reach downstream of the diversion dam. However, substantial quantities of sediments would still be transported down the creek by high flows (over 650 cfs) during heavy rains. The annual sluicing of sediments accumulated behind the diversion dam would continue with the WSIP. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

Implementation of the WSIP would reduce flow in Alameda Creek downstream of the San Antonio Creek confluence in winter months of normal to wet years, ranging from a -18 percent decrease to a +13 percent increase in flow at the USGS Niles gage station. In the majority of winter months (December to March), flows at this location would decrease, but in April and May the flows would exhibit small to moderate increases. Although implementation of the WSIP would result in additional flow in Alameda Creek in summer months as part of the 1997 CDFG MOU releases, these additional flows would not mobilize significant amounts of sediment and could be recaptured at a location downstream of the Sunol Valley WTP. This net decrease in flow in Alameda Creek below the San Antonio Creek confluence when compared to the existing condition would likely result in a slight decrease in the amount of sediment transported in Niles Canyon and lower Alameda Creek and would therefore decrease sediment and debris loading on lower Alameda Creek facilities.

As noted in Impacts 5.4.2-1 and 5.4.2-3, flows and the resulting impacts on geomorphology upstream of the San Antonio Creek confluence are expected to be within the range of conditions that have been experienced since development of water supply and flood control facilities in the upper and lower Alameda Creek watershed. Therefore, implementation of the WSIP would not significantly alter bed or channel form or introduce substantial new sources of sediment.

As a result of this net decrease in sediment transport in Niles Canyon and the less-than-significant impacts in upper Alameda Creek, the impact related to geomorphologic characteristics and sediment transport along Alameda Creek downstream of the San Antonio Creek confluence would be *less than significant*. It should also be noted that the Arroyo de la Laguna watershed is the major contributor to sediment supply in Niles Canyon and lower Alameda Creek.

[Additional discussion on geomorphology in Alameda Creek downstream of the diversion dam was prepared in response to comments on the Draft PEIR. Please refer to Section 15.2, response to the letter from the Regional Water Quality Control Board, San Francisco Bay Region, (Vol. 7, Chapter 15).]

Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir.

Current spills from San Antonio Reservoir are minimal and would continue to be minimal. Therefore, impacts on fluvial geomorphologic characteristics would be *less than significant*, and no mitigation measures would be required.

References – Geomorphology

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5.4.3 Surface Water Quality

The following setting section describes surface water quality in streams and reservoirs in the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.3.2) provides a description of the changes in water quality in streams and reservoirs that would result from WSIP-induced changes in stream flow and reservoir water levels.

5.4.3.1 Setting

Calaveras Reservoir

Calaveras Reservoir collects and stores water from the local watershed; this water is subsequently treated at the Sunol Valley WTP and distributed for municipal use. Reservoir inflow is dominated by winter rainfall events. Because the reservoir stores local runoff only, water quality is fairly consistent. However, the reservoir stratifies during the warm months, which leads to changes in water quality depending on the time of year and depth within the reservoir. When the reservoir stratifies during the late summer and fall, the bottom, lower layer (the "hypolimnion") is aerated to increase oxygen levels, thereby reducing the concentrations of dissolved iron, manganese, and hydrogen sulfide in the raw water (Weiss Associates, 2003).

Calaveras Reservoir exhibits characteristics typical of "mesotrophic"[1] waters, which include the following:

- Moderate nutrient levels and microbiological activity
- Oxygen concentrations that may vary considerably
- Variable light penetration
- Shallow to deep lake with sloping sides
- Potentially fertile soils, heavily vegetated and/or disturbed watershed (SFPUC, 2002)

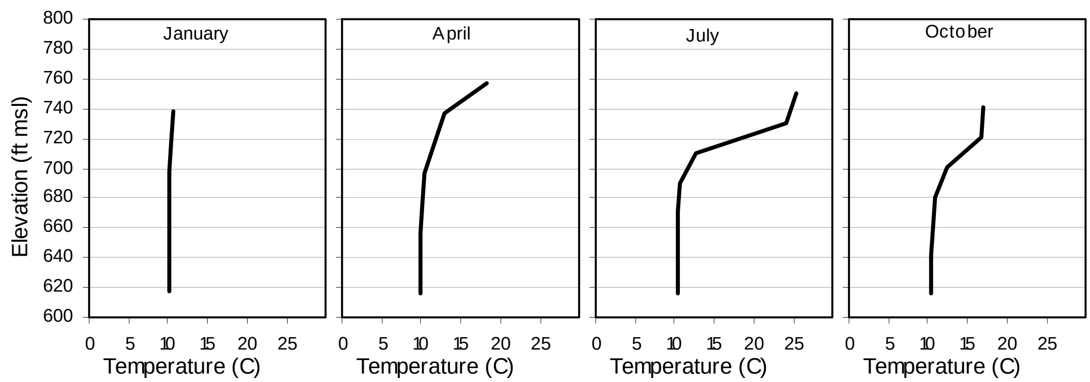
The biggest water quality concerns in the reservoir are turbidity and algae control. Algal blooms can result in consumer complaints regarding odor and taste and can also limit production at the Sunol Valley WTP due to increases in filter head loss. Several algal blooms have caused the reservoir to be temporarily removed from production, and an algae bloom in October 2003 was treated with copper sulfate. The reservoir is sampled every two weeks for basic water quality parameters; algal growth is usually indicated by increasing surface dissolved oxygen (DO) levels and a rise in pH, with June and October generally being the months of greatest concern. Problems with algal growth often resolve themselves as zooplankton feed on the algae; however, zooplankton may not be completely effective in controlling blue-green algae (SFPUC, 2002). The growth of blue green algae is occasionally managed with low doses of copper sulfate, which is the only herbicide used in the reservoir. Treatment with copper sulfate can reduce DO levels associated with the decay of dead algae (SFPUC, 2002).

Reservoir water temperature is considered a key water quality parameter with respect to aquatic life. Calaveras Reservoir water temperatures are typically isothermal[2] during December through

1 The ratio of watershed to surface area is 60:1, which places the lake in the "potentially mesotrophic" group.

February, which indicates complete mixing of the reservoir. From March through November, the reservoir typically stratifies, with the most intense period between June and October; during this time, the thermocline[3] is 20 to 40 feet below the water surface, with water temperatures reaching 24 to 26 degrees Celsius (°C) in the upper level of the water (the “epilimnion”), and 10 to 14 °C in the hypolimnion (Weiss Associates, 2003).[4]

Figure 5.4.3-1 presents water temperature profiles for Calaveras Reservoir during 1998. These data were collected before the DSOD limited the operational capacity of the reservoir due to seismic concerns, and thus represent a “full” reservoir.



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SOURCE: SFPUC, HH/LSM (Appendix H)

Figure 5.4.3-1
Temperature Profiles for Calaveras Reservoir, 1998

Water quality conditions in the reservoir are shown in **Table 5.4.3-1**. When Calaveras Reservoir is isothermal, DO concentrations are near saturation; however, when the reservoir stratifies, DO concentrations in the hypolimnion historically dropped to less than 1 mg/L while remaining near saturation in the epilimnion. The values for pH ranged from 6.6 to 8.3, and turbidity remained below 5 nephelometric turbidity units (NTU) throughout most of the year. The SFPUC commissioned a feasibility study to select a technology for effectively maintaining the DO concentration within the hypolimnion at levels protective of water quality (DO > 2 mg/L) and fish habitat (DO > 5 mg/L) (Merritt-Smith Consultants, 2003). The technology selected was an “unconfined small bubble soaker hose diffuser” consisting of approximately 1,000 feet of diffuser operated from a liquid oxygen supply based on the lake shoreline. The oxygen is distributed along the full length of the line deep within the reservoir during operation, thus spreading the oxygen

2 Refers to constant temperature in the water column; this conditions is present when the reservoir is not stratified, typically during the winter months.
3 The boundary between the warmer surface waters and cooler waters below.
4 To convert Fahrenheit to Celsius (Centigrade), subtract 32 and divide by 1.8. To convert Celsius (Centigrade) to Fahrenheit, multiply by 1.8 and add 32.

TABLE 5.4.3-1
SUMMARY OF WATER QUALITY IN CALAVERAS RESERVOIR

Parameter	Value	Status
Nitrate – winter average (mg/L)	0.13	Mesotrophic[c] to Eutrophic[d]
Orthophosphate – winter average (mg/L)	0.018	Mesotrophic
Total Phosphorus – winter average (mg/L)	0.06	Mesotrophic to Eutrophic
Secchi Depth[a] – growth season average (feet)	22.2	
Secchi Depth – growth season minimum (feet)	13.0	Mesotrophic
Chlorophyll *a* – annual average (µg/L)	4	Eutrophic
Chlorophyll *a* – annual peak (µg/L)	18	Eutrophic
Anoxia[b] presence	None	Eutrophic
Anoxia duration (days)	0	Mesotrophic to Eutrophic
Anoxic extent (acre-feet)	0	Eutrophic

µg/L = micrograms per liter; mg/L = milligrams per liter

a Secchi depth is a parameter used to determine the clarity of surface waters. High secchi depth readings indicate clearer water that allows sunlight to penetrate deeper.
b Anoxia generally refers to low-oxygen conditions in the hypolimnion.
c A body of water that has a moderate amount of dissolved nutrients.
d A body of water that is rich in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life, resulting in the depletion of dissolved oxygen.
SOURCE: SFPUC, 2002.

over a large area to achieve high oxygen transfer efficiencies and reduce oxygen expenditures. The oxygenation system has been implemented in Calaveras Reservoir and maintains DO values in the hypolimnion at between 2 and 5 mg/L (Merritt-Smith Consultants, 2003).

Calaveras Reservoir under low storage conditions remains sufficiently deep (approximately 80 to 90 feet) to experience persistent seasonal thermal stratification. The reservoir becomes strongly stratified by late June and generally develops a thermocline at approximately 30 feet of depth, with the hypolimnion occupying the bottom 40 or so feet of the reservoir profile. The historical depth to the thermocline was similar, but the reservoir maintained a notably deeper hypolimnion.

San Antonio Reservoir

San Antonio Reservoir receives both local runoff (including inflow from Calaveras Reservoir) and Hetch Hetchy water, and its water quality is therefore more variable than that of Calaveras Reservoir. Like Calaveras Reservoir, San Antonio Reservoir exhibits characteristics typical of mesotrophic[5] waters; however, the moderate algal biomass present in San Antonio Reservoir is more typical of eutrophic[6] waters (SFPUC, 2002).

As in Calaveras Reservoir, the biggest water quality concerns in San Antonio Reservoir are turbidity and algae control; the SFPUC has occasionally applied copper sulfate to control algal blooms in San Antonio Reservoir, –but has ceased use of copper sulfate until it receives

5 The ratio of watershed to surface area is 30:1, which places the lake in the “potentially mesotrophic” group.
6 Generally warm and shallow waters, with high nutrient levels and high microbiological activity.

applicable permits from the Regional Water Quality Control Board (RWQCB). **Table 5.4.3-2** summarizes San Antonio Reservoir's water quality parameters, including the nutrient status and associated level of microbiological activity.

TABLE 5.4.3-2
SUMMARY OF WATER QUALITY IN SAN ANTONIO RESERVOIR

Parameter	Value	Status
Nitrate – winter average (mg/L)	0.104	Mesotrophic
Orthophosphate – winter average (mg/L)	0.028	Mesotrophic
Total Phosphorus – winter average (mg/L)	0.060	Eutrophic
Secchi Depth[a] – growth season average (feet)	11.8	
Secchi Depth – growth season minimum (feet)	3.8	Eutrophic
Chlorophyll *a* – annual average (µg/L)	3.187	Eutrophic
Chlorophyll *a* – annual peak (µg/L)	14.68	Eutrophic
Anoxia[b] presence	Regularly	Eutrophic
Anoxia duration	Average approximately 90 days/year	Mesotrophic to Eutrophic
Anoxic extent	Entire hypolimnion	Eutrophic

µg/L = micrograms per liter; mg/L = milligrams per liter

[a] Secchi depth is a parameter used to determine the clarity of surface waters. High secchi depth readings indicate clearer water that allows sunlight to penetrate deeper.
[b] Anoxia generally refers to low-oxygen conditions in the hypolimnion.

SOURCE: SFPUC, 2002.

Occasional transfers of large quantities of South Bay Aqueduct water into San Antonio Reservoir have degraded the reservoir water by adding contaminants, including total dissolved solids, total organic carbon, and bromides. The last such transfer, which occurred during the 1990–1991 drought, significantly degraded water quality in the Alameda system.

Alameda Creek Below the Diversion Dam

Water quality in Alameda Creek is generally good and is protective of beneficial uses. In terms of aquatic life, the key water quality parameter is temperature, which is directly related to hydrologic flow conditions. **Table 5.4.3-3** summarizes weekly water temperature data collected by the ACWD near Sunol, above Arroyo de la Laguna, from 1997 through 2005. Average monthly water temperatures show an expected seasonal trend (i.e., cooler during the winter and warmer during the summer).

Water temperatures in Alameda Creek have been shown to vary widely in Niles Canyon, with average daily temperatures generally peaking in late August in the 20 to 30 °C range (68 to 86 degrees Fahrenheit), and daily temperature fluctuations ranging between 1 and 11 °C, depending on geographic location and the degree of riparian shading (San Francisco Planning Department, 2005).

TABLE 5.4.3-3
SUMMARY OF TEMPERATURE DATA, ALAMEDA CREEK NEAR SUNOL, 1997–2005
(degrees Celsius)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	10	13	15	18	21	23	–	–	–	–	–	10
1998	11	11	14	16	16	18	23	26	22	15	13	11
1999	7	11	13	16	17	23	–	–	–	–	–	–
2000	13	13	15	16	22	25	22	21	–	18	13	11
2001	10	11	17	18	22	–	–	–	–	–	15	12
2002	12	12	13	17	18	21	19	22	21	21	15	10
2003	–	–	–	–	–	–	–	22	–	–	–	12
2004	13	12	15	16	18	20	19	–	–	–	–	–
2005	9	13	12	13	18	22	23	24	21	19	14	11
Average	11	12	14	16	19	22	21	23	21	18	14	11

SOURCES: ACWD (raw data provided by Laura Hidas); Merritt Smith Consulting (data reduction). Note that ACWD temperature data may not have been subject to the rigorous QA/QC procedures required for scientific studies, and therefore should be used only to indicate general conditions (unless otherwise specified by the ACWD).

Water temperatures in Niles Canyon reflect seasonal meteorological conditions, with cool temperatures in winter, warm temperatures in summer, and intermediate temperatures in the spring and fall. Under predevelopment conditions, a naturally high groundwater table in the Sunol Valley may have provided base flow during the low-flow periods. Subsurface accretions such as these can provide thermal benefits during summer periods, because groundwater temperatures tend to be relatively constant at approximately the mean annual air temperature of the local area (Holmes, 2000). The degree of predevelopment groundwater/stream interaction is unknown, and the extent of any potential thermal benefit is likewise uncertain. Nonetheless, under current conditions, the flow of subsurface water into mining pits during gravel mining operations has lowered the groundwater table to the extent that Alameda Creek at the head of Niles Canyon may retain only very low flows during the summer period (Bookman-Edmonston Engineering, Inc., 1995). A review of temperature studies presented by Hanson (2003) indicates that water temperatures in Alameda Creek are at or close to the equilibrium temperature (i.e., in equilibrium with the atmosphere) by the time flows reach Niles Canyon. Thus, in summer periods, water temperatures typically exceed 25 ^{o}C for multiple consecutive days. Although there is topographic and riparian shading in the canyon, local meteorological conditions are not sufficiently moderated by these shading sources to provide consistently low water temperatures through the summer. There are most likely local cool patches where hyporheic flow (water that interchanges between the stream and subsurface media) provides some moderation of water temperatures. However, such areas are not believed to be widespread or to provide extensive, persistent cool water. Summer and fall flows in Alameda Creek and its tributaries are at their seasonal low. Thus, flows in Alameda Creek below its confluence with Arroyo de la Laguna tend to be warm during these periods, because coldwater sources are largely unavailable in these reaches and base flows are low during this time of year, allowing waters to warm towards their natural temperature in equilibrium with meteorological conditions. In addition, flows in Arroyo de la Laguna appears to be higher in total dissolved solids (TDS) than the flows in Alameda Creek originating from the watershed upstream of Arroyo de la Laguna (RWQCB, 2008).

Increased flows may moderate maximum daily temperatures by increasing the thermal mass of the stream (i.e., the quantity of cooler water in the stream that would be subject to warming by the air).

Table 5.4.3-4 provides a summary of TDS data for the same location and period as for temperature, above. Unlike temperature, TDS does not exhibit a seasonal trend. TDS is an indicator of the overall content of inorganic materials in the water. As shown in the table, TDS is well below the secondary maximum contaminant level for drinking water (established to protect aesthetic quality) of 500 mg/L. Nitrate averages were 0.8 mg/L (as N) over the 1997–2005 period; the primary drinking water standard is 10 mg/L.

TABLE 5.4.3-4
SUMMARY OF TDS DATA, ALAMEDA CREEK NEAR SUNOL, 1997–2005
(milligrams per liter)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	–	–	190	266	280	268	–	–	–	–	–	306
1998	233	148	180	195	235	260	279	284	283	309	233	381
1999	313	228	259	276	309	298	–	–	–	–	–	–
2000	361	286	209	305	304	315	319	320	–	331	359	367
2001	486	389	361	367	355	–	–	–	–	–	338	277
2002	186	258	273	278	278	278	291	260	323	334	368	332
2003	–	–	–	–	–	–	–	365	–	–	–	407
2004	313	299	366	307	322	343	348	–	–	–	–	–
2005	246	297	205	192	247	256	290	281	304	302	337	314
Average	305	272	255	273	291	288	305	302	303	319	327	341

SOURCES: ACWD (raw data provided Laura Hidas); Merritt Smith Consulting (data reduction). Note that ACWD TDS data may not have been subject to the rigorous QA/QC procedures required for scientific studies, and therefore should be used only to indicate general conditions (unless otherwise specified by the ACWD).

Regulatory Considerations

As described in Section 5.2, the San Francisco Bay RWQCB regulates water quality in the San Francisco Bay region under the Porter-Cologne Water Quality Control Act. Beneficial uses of surface waters in the Alameda Creek watershed as well as impaired water bodies are shown in **Table 5.4.3-5**. The beneficial uses of the water bodies generally apply to all tributaries.

5.4.3.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to surface water quality, but generally considers that implementation of the proposed program would have a significant surface water quality impact if it were to:

- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

TABLE 5.4.3-5
ALAMEDA DRAINAGE WATER QUALITY REGULATIONS

Water Body	
	Designated Beneficial Uses
Alameda Creek	AGR, COLD, GWR, MIGR, REC-1, REC-2, SPWN, WARM, WILD
Arroyo Hondo	COLD, FRSH, MUN, REC-1, REC-2, SPWN, WARM, WILD
Calaveras Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
San Antonio Reservoir	COLD, MUN, REC-1 (limited), REC-2, SPWN, WARM, WILD
	Clean Water Act Section 303(d) List of Impaired Water Bodies
Alameda Creek	Pollutant: Diazinon Potential Sources: Urban runoff/storm sewers Total Maximum Daily Load Priority: High

Beneficial Uses Key:

MUN (Municipal and Domestic Supply); AGR (Agriculture); REC-1 (Body Contact Recreation); REC-2 (Noncontact Recreation); WARM (Warm Freshwater Habitat); COLD (Cold Freshwater Habitat); MIGR (Fish Migration); SPWN (Fish Spawning); WILD (Wildlife Habitat); NAV (Navigation); GWR (Groundwater Recharge); FRSH (Freshwater Replenishment); SHELL (Shellfish Harvesting); COMM (Ocean, Commercial, and Sport Fishing); EST (Estuarine Habitat); IND (Industrial Service Supply).

SOURCE: SWRCB, 2003.

Approach to Analysis

Changes in water quality are based on qualitative analyses of potential water quality effects due to changes in flows within creeks and changes in reservoir levels, as predicted by the HH/LSM. An overview of the model is presented in Section 5.1, and the model assumptions are provided in Appendix H.

Impact Summary

Table 5.4.3-6 presents a summary of the impacts on surface water quality in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.3-6
SUMMARY OF IMPACTS – SURFACE WATER QUALITY
IN ALAMEDA CREEK WATERSHED STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir	LS
Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir	LS
Impact 5.4.3-3: Effects on water quality along Calaveras, San Antonio, and Alameda Creeks	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.4.3-1: Effects on water quality in Calaveras Reservoir.

Under the WSIP, Calaveras Reservoir would be replaced and its original capacity restored (see Chapter 3 for a description of reservoir operations under the WSIP). Compared with existing conditions, the reservoir would be maintained at a higher storage level. In addition, the new dam outlet works would allow greater flexibility to manage both in-pool and downstream conditions by providing a wider range of controlled releases, selective withdrawal, and improved spill management. Maintaining higher overall storage compared with DSOD-imposed levels would create a larger hypolimnion, leading to similar or greater cold/cool water volumes.

Temperature. The temperature impact under proposed operations is expected to be minimal. Maintaining higher overall storage volumes would create a larger hypolimnion, leading to similar or greater cold/cool water volume. Historical summer cool water pool volumes on the order of 25,000 to 35,000 acre-feet could again be expected with the proposed program. Seasonal thermal stratification dynamics would follow a similar pattern, with the onset of stratification occurring in April, and fall destratification largely complete by November. April through October stream releases would average approximately 3,800 acre-feet (13 percent of the cool water pool[7]). In all hydrologic year types except for the wettest years, the April through October release volume would range from approximately 2,850 to 3,050 acre-feet (9 to 10 percent of the cool water pool), while in the wettest year the release volume would be approximately 7,400 acre-feet (25 percent of the cool water pool). These release volumes would not deplete the cool water pool and would not lead to substantial changes in the thermal structure of the reservoir.

Dissolved Oxygen. Historically (i.e., before the 2002 DSOD restriction), Calaveras Reservoir experienced seasonal anoxia (DO concentrations less than 2 mg/L) during summer and early fall thermal stratification. In an effort to maintain aquatic habitat for fish and to minimize water quality impacts under this reduced reservoir storage condition, an oxygenation system was installed to ensure DO concentrations of up to 5 mg/L in the hypolimnion during summer periods. The oxygenation system has the flexibility to be operated in a larger reservoir and would continue to be operated when the dam is replaced. Thus, DO conditions would be equal to or improved over the existing condition, with DO concentrations maintained to eliminate low-oxygen conditions in the hypolimnion.

Water Quality – Nutrients. As described above in Section 5.4.3.1, Setting, Calaveras Reservoir is mesotrophic; implementation by the SFPUC of oxygenation technology has maintained or improved water quality within the reservoir and would continue to do so under the WSIP. Proposed reservoir storage and operations would not affect the maintenance of water quality; with the oxygenation system in place, overall nutrient levels would likely be lower and algal biomass reduced compared with existing conditions. Furthermore, the restored reservoir capacity would result in greater natural sedimentation relative to the current condition, which would attenuate turbidity spikes during heavy runoff.

7 The assumed cool water pool volume is 30,000 acre-feet.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would maintain or improve water quality parameters in Calaveras Reservoir. Therefore, impacts on water quality in Calaveras Reservoir would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir.

Under the WSIP, controlled releases from San Antonio Reservoir would be maintained at zero, while uncontrolled releases (spills) would be reduced under future operations (compared with the modeled existing condition). As noted above, drawdown would be less (i.e., the reservoir would generally be maintained at a higher storage volume); supply to the Sunol Valley WTP would change from historical operations, with larger inflows in the rainy season and lower inflows in the dry season. Maintaining higher overall storage could create a slightly larger hypolimnion, leading to similar or larger cold/cool water volumes during summer periods.

Temperature. The temperature impact under proposed operations is expected to be minimal. Maintaining higher overall storage would create a larger hypolimnion, leading to similar or larger cold/cool water volumes. Historical summer cool water pool volumes were on the order of 12,000 to 20,000 acre-feet and are expected to be similar under future operations. Seasonal thermal stratification dynamics would follow a similar pattern, with the onset of seasonal stratification occurring in April, and fall destratification largely complete by November.

Dissolved Oxygen. Historically, San Antonio reservoir experienced seasonal anoxia (DO concentrations less than 2 mg/L) during summer and early fall thermal stratification. DO conditions are expected to be similar under future operations.

Water Quality – Nutrients. As described above in Section 5.4.3.1, San Antonio Reservoir is mesotrophic; Merritt-Smith Consultants (2003) determined that oxygenation was an appropriate measure to maintain and possibly improve this status. However, this technology has not been implemented. Future operations are expected to minimize inputs of lower quality water from State Water Project sources (i.e., the Delta), which could improve reservoir water quality. Overall nutrient and algae levels under the WSIP are expected to be similar to current conditions.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would maintain water quality parameters in San Antonio Reservoir. Therefore, impacts on water quality in San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.3-3: Effects on water quality along Calaveras, San Antonio, and Alameda Creeks.

Calaveras Creek

The primary source of Calaveras Creek flow is Calaveras Reservoir releases. There are no appreciable tributaries between Calaveras Dam and the Alameda Creek confluence.

Temperature. Water temperatures under future operations are expected to be similar to existing conditions. Winter temperatures are expected to be low due to seasonally wet and cool conditions. During the warmer periods of the year, water temperatures are expected to be similar in normal, above-normal, and wet years because release quantities would be the same. In below-normal and dry years, water temperatures are expected to be similar or lower under future operations because flows would be increased, while release temperatures would stay approximately the same. This increased flow would not lead to an appreciable thermal benefit far downstream, because eventually the waters would warm, attaining equilibrium with local meteorological conditions (see Alameda Creek, below).

Studies conducted for the 1997 MOU between the CDFG and CCSF contemplated that a 7-cfs release from Calaveras Reservoir would result in cooler temperatures for the upper half of the stream reach between the Alameda/Calaveras Creek confluence and the Sunol Valley WTP. Furthermore, the existing oxygenation system, which is also planned to be used in future operations, would maintain desired DO conditions in reservoir waters, which would further enhance DO conditions in the downstream reach. If MOU releases are from Alameda Creek upstream of Calaveras Creek, then Calaveras Creek would not receive the temperature benefits of these releases, and temperatures would remain as in the base case.

Dissolved Oxygen. DO conditions below Calaveras Dam would depend on water quality conditions in the reservoir. Because oxygenation has been implemented in Calaveras Reservoir since 2002 and would continue to be implemented with the WSIP, DO conditions downstream of the dam would be similar to current conditions.

Water Quality – Nutrients. Any improvements in water quality conditions in Calaveras Reservoir would also occur in released waters downstream of the dam. The trapping of nutrients in the reservoir sediments upstream could reduce nutrients in downstream waters. In addition, oxidation of ammonia to nitrate in the reservoir (“nitrification”) would minimize the potential for excess ammonia releases from the reservoir. These benefits would maintain low oxygen demands (due to the nitrification of ammonia to nitrate) as well as a low potential for un-ionized ammonia, which can be harmful to aquatic life.

San Antonio Creek

The WSIP would not change release mechanisms at the Turner Dam on San Antonio Reservoir. Controlled releases would be maintained at zero, while modeled uncontrolled releases would increase in January and February, but decrease in March and April. Because reservoir temperature, DO, and levels of nutrients and associated constituents are not expected to change, significant adverse impacts related to these water quality parameters are not expected.

Alameda Creek

Two reaches of Alameda Creek are discussed below:

- Reach 1 – from the diversion tunnel to Alameda Creek's confluence with Calaveras Creek
- Reach 2 – from the confluence with Calaveras Creek downstream

Reach 1

Temperature. Water temperatures in Alameda Creek in the vicinity of the diversion dam reflect seasonal meteorological conditions (cool winter, warm summer, and intermediate spring and fall temperatures). Reach 1 would experience lower flows under future operations. The bulk of the flow changes would occur from December through April, with modest changes in May during the wetter years. In general, Alameda Creek flows below the diversion tunnel to the creek's confluence with Calaveras Creek would be lower under future operations.

Dissolved Oxygen. Although minimal DO data exist for Alameda Creek throughout much of its watershed, DO conditions in the creek are presumed to be consistent with other wildland creeks of the Bay Area (i.e., near saturation and in equilibrium with the atmosphere). Under future operations, these conditions are not expected to change.

Water Quality – Nutrients. Alameda Creek upstream of the diversion dam is largely an undeveloped watershed with no storage reservoirs. This fact, coupled with flow changes that would be largely limited to December through April (when primary production is low), suggests that water quality impacts due to future operations are not likely to change nutrient conditions in this reach.

Settleable Materials, Suspended Materials, and Turbidity. Sections 5.4.1.1 and 5.4.2.1 describes the SFPUC flushing activities intended to remove accumulations of coarse sediment to protect the facility, maintain storage capacity (and thus diversion capacity) above the Alameda Creek Diversion Dam, and support downstream geomorphic processes by passing sediment. The flushing procedure involves opening the sluice gates to flush coarse sediments from upstream of the diversion dam. Sediment flushing discharges approximately 900 cubic yards of sediment from behind the diversion dam each year, and typically occurs in February. This sediment typically consists of sands and gravels. Operations normally occur over a 48-hour period during high-flow events to develop the necessary velocity to mobilize the coarse sediments behind the dam. Flushing operations occur whether or not flows from the creek are being diverted to the diversion tunnel. The sluice gates remain closed year-round, except during the sluicing procedure. If water is not diverted via the diversion gates to the reservoir, the entire volume of the creek flows through the sluice gates in the dam or over the top of the dam. It is assumed that these SFPUC sediment flushing activities and sluice gate operations would continue under the WSIP.

Three water quality parameters—settleable materials, suspended materials, and turbidity—could be affected by changes in the Alameda Creek Diversion Dam operations and sediment flushing procedures. It is likely that more sediment would be transported to Calaveras Reservoir with the WSIP than under current conditions because of increased flows diverted to Calaveras Reservoir. Many of these sediments would settle out in the reservoir, reducing the overall quantity of sediments in the creek. Therefore, less sediment would be available for transport (either in flows over the dam or via sluicing/flushing operations) down Alameda Creek compared to the existing condition. Therefore, the sluicing/flushing procedures under the WSIP would have less-than-significant water quality impacts with respect to settleable materials, suspended materials, and turbidity.

Reach 2

Temperature. Below the Alameda Creek confluence with Calaveras Creek, lower Calaveras Creek temperatures associated with future operations of Calaveras Dam would also affect Alameda Creek temperatures. The effects would be moderated because of mixing with Alameda Creek flows. Cooler waters in Calaveras Creek would commingle with Alameda Creek flows and generally approach equilibrium temperature in response to local meteorological conditions as waters traversed this reach. During winter periods, water temperatures would be the same under future conditions. During summer periods, flows from Calaveras Creek might be less than equilibrium temperature (i.e., cooler than Alameda Creek waters) at the confluence. The result is that proposed Calaveras Creek flows could reduce Alameda Creek water temperatures; however, it is likely that these waters would warm towards equilibrium over the next several miles.

Dissolved Oxygen. Both Alameda and Calaveras Creeks are expected to have DO conditions at or near saturation under existing and future conditions. Deviations from saturation concentration could occur in response to primary production (photosynthesis and respiration of algae), but these conditions are not expected to change under proposed operations. Overall, DO conditions in Alameda Creek are not expected to change substantially under future operations.

Water Quality – Nutrients. Any reduction in nutrients and algae in Calaveras Reservoir would also occur in released waters downstream of the dam, and potentially in Alameda Creek as well. The impact of these reductions in Alameda Creek below the confluence of Calaveras Creek is uncertain. Nutrient and algae conditions in Alameda Creek are expected to be similar under future operations.

As described above, the WSIP would not substantially degrade water quality parameters in Alameda and Calaveras Creeks; therefore, impacts on these conditions would be less than significant.

Impact Conclusions

Overall, impacts on water quality along Calaveras, San Antonio, and Alameda Creeks would be *less than significant*, and no mitigation measures would be required.

[Additional discussion on water quality in Alameda Creek downstream of the diversion dam was prepared in response to comments on the Draft PEIR. Please refer to Section 15.2, response to the letter from the Regional Water Quality Control Board, San Francisco Bay Region, (Vol. 7, Chapter 15)]

References – Surface Water Quality

Alameda County Water District (ACWD), website, http://www.acwd.org/sources_of_supply.php5, accessed June 11, 2007.

Bookman-Edmonston Engineering, Inc., prepared for San Francisco Water Department, *Alameda Creek Water Resources Study*, Appendix A-5 of the *Alameda Watershed Management Plan*, 1995.

Hanson Environmental, Inc., *Supplemental Air and Water Temperature Monitoring Within Alameda Creek*, December 25, 2003.

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San Francisco Planning Department, *Sunol/Niles Dam Removal Project, Draft Environmental Impact Report*, October 2005, prepared by ESA for the San Francisco Planning Department.

San Francisco Public Utilities Commission (SFPUC), *Reservoir Water Quality Management Plans*, March 2002.

State Water Resources Control Board (SWRCB), 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segment. Approved by the U.S. EPA in July 2003.

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5.4.4 Groundwater

The primary groundwater resources in the Alameda Creek watershed are in the Livermore and Sunol Valleys, and farther downstream in the Niles Cone area near the town of Niles. In CCSF-owned watershed areas upstream of the Livermore and Sunol Valleys, small amounts of localized groundwater can be found in the shallow alluvial areas that are interspersed with steeper bedrock sections along watercourses. Groundwater in these areas is often through-flow associated with flows in the streams. Because the proposed program would not affect upstream areas in the Livermore Valley or lower areas in the Niles Cone (which is below the SFPUC's infiltration galleries), this section focuses on describing the groundwater conditions and potential WSIP impacts in the Sunol Valley.

5.4.4.1 Setting

Local Geology

The Alameda Creek watershed generally comprises northwest-trending ridges and intervening valleys, the orientations of which are strongly controlled by the structural grain of the underlying bedrock (refer to Chapter 4, Section 4.3, Geology, Soils, and Seismicity). For the purposes of visualizing the groundwater system in the program area, the geologic units can be divided into two main types. The deepest bedrock is characterized by well-compacted and lithified marine sedimentary rocks (Panoche Formation). Because of their compact nature, low permeability, and strong structural deformation, these rocks are considered non-water-bearing or, at best, very low water-yielding (Ludhorff and Scalmanini, 1993).

In contrast, the younger surficial deposits are unconsolidated to only slightly compacted. These units are nonmarine, alluvial fan, and stream channel deposits of interbedded gravel, sand, silt, and clay beds. The lower portion of this sequence, the Livermore Gravels, is more consolidated than the upper portion and is less water-bearing. The upper coarser-grained sand and gravel beds have high porosity and permeability and are considered water-bearing and high water-yielding. The upper alluvial deposits range from 30 to 60 feet thick and probably constitute the most significant groundwater aquifer in the program area (Luhdorff and Scalmanini, 1993).

Hydrogeology

The upper aquifer described above is "unconfined," meaning that the water table fluctuates in response to recharge (precipitation in the wet season) and discharge (evapotranspiration[1] in the dry season). Significant alluvial deposits have been removed by gravel mining upstream from the location of the former Sunol Dam.

Historical groundwater observations by quarry operators suggest that the majority of groundwater inflow occurs from the upper alluvium within about 50 feet of the ground surface (Luhdorff and Scalmanini, 1993). The water-bearing capability and permeability of the deeper zone, the

1 The return of water from the soil and from plants to the atmosphere by evaporation and transpiration.

Livermore Gravels, is lower than that of the shallow alluvium. The contact between the relatively impermeable Livermore Gravels and the highly permeable shallower zone decreases the potential for recharge of the Livermore Gravels via alluvium. Prior to development, groundwater recharge of Sunol Valley alluvium occurred primarily as seepage from the Alameda Creek stream channel and percolation of direct precipitation. Groundwater levels would have been highest during and just after the rainy season and lowest during summer and until the beginning of the wet season. Discharge from the basin would have consisted primarily of groundwater seepage to the channels of Alameda Creek and Arroyo de la Laguna at the downstream end of the valley (Bookman-Edmonston Engineering, Inc., 1995). Prior to construction of Sunol Dam, which artificially raised the water table, groundwater levels in the downstream end of the valley were lower than those observed today.

Sunol Infiltration Galleries

Sunol Dam was built around 1899 by the Spring Valley Water Company to maintain hydraulic head[2] within the shallow alluvium upstream of the dam, adjacent to and underlying the Alameda Creek bed. These deposits host the Sunol infiltration galleries. The infiltration galleries are comprised of a series of concrete tunnels along with perforated pipe placed in the shallow alluvium under Alameda Creek, perpendicular to the creek banks; the galleries provide a location for temporary aquifer recharge (deposit) and recovery (withdrawal) (see **Figure 5.4.4-1**). Historically, surface water from Alameda Creek, particularly peak storm flows, were detained behind both permanent and temporary dams and seeped into the gravels for recovery by the infiltration galleries. The infiltration galleries were not designed to "draw down" groundwater levels, but rather to intercept surface water from Alameda Creek. In this way, short-duration high flows in Alameda Creek resulting from heavy rainfall events were diverted and temporarily stored before being recovered over a longer time period by the infiltration galleries. Dependable yield from the infiltration galleries was 5 mgd, but under flood conditions the fully operational galleries could produce well over 20 mgd (SFPUC, 1960).

After completion of the Calaveras Pipeline in 1934, flows of stored water from Calaveras Reservoir were reduced, and the yield of the infiltration galleries declined. Recharge to the galleries was further reduced in 1965 when construction of San Antonio Dam eliminated supply from San Antonio Creek. In addition, beginning in the late 1960s, gravel mining began altering groundwater flow patterns in the valley. As a result of the quarry operations, groundwater levels in portions of the valley are lower than during the first half of the last century, and flows formerly captured and diverted into the infiltration galleries have decreased in recent years (Bookman-Edmonston Engineering, Inc., 1995). Sunol Dam was removed in September 2006. Removal of this dam is likely to further decrease flows captured in the infiltration galleries.

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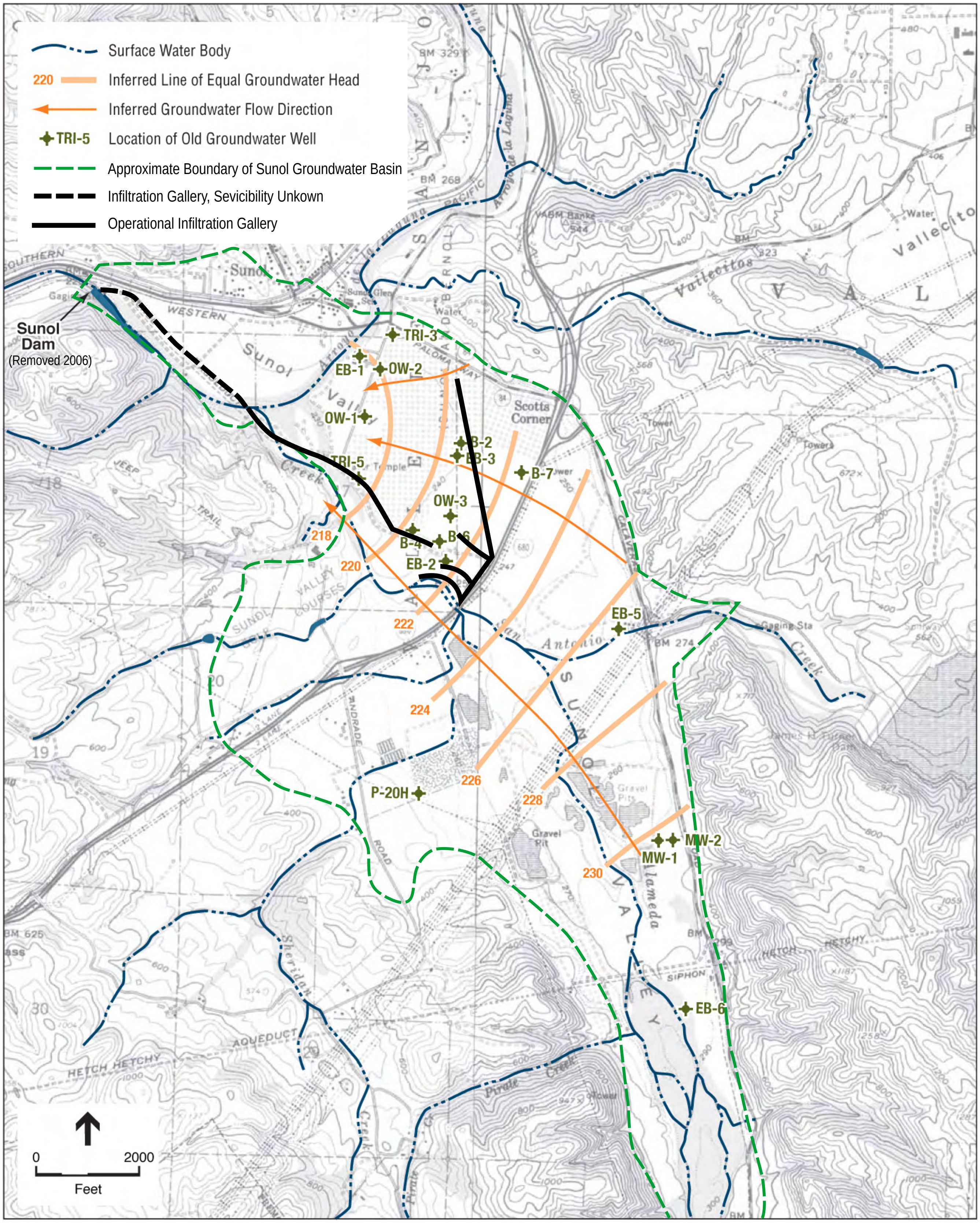
2 Hydraulic head is the pressure of the water column and elevation difference. Fluids flow down a hydraulic gradient, from points of higher to lower hydraulic head.



SOURCE: Hydroconsult Engineers, Inc., 2005;
Adapted from Luhdorff and Scalmanini, 1993.
Maptech USGS base map

SFPUC Water System Improvement Program . 203287

Figure 5.4.4-1
Sunol Groundwater Basin Groundwater Elevations and Flow Directions

Other than the infiltration galleries, only incidental groundwater development, consisting of a small number of wells for water supply, occurred in the Sunol Valley until recent times. The Sunol Valley Golf Course uses up to 1 mgd of local groundwater. The SFPUC recently installed a new irrigation supply system for the golf course.

Groundwater Observations

Available groundwater data for the Sunol Valley are limited. Investigations conducted in 1986 by the ACWD and in 1989 by the Mission Valley Rock Company involved the installation of several small-diameter monitoring wells throughout the valley. Water levels were measured at the time of installation, but since then have not been routinely measured. Luhdorff and Scalmanini measured water levels in existing wells several times in 1992 and 1993. The ground surface elevations of the wells were estimated, either by survey or reference to available topographic maps.

Generally, comparison of seasonally collected water levels showed relatively small variations from spring to fall. Luhdorff and Scalmanini (1993) concluded that overall groundwater levels in the Sunol Valley range from 20 to 30 feet below ground surface, with probable localized depressions around gravel quarries. The inferred groundwater level contours, using 1992 data, approximately parallel the ground surface contours of the valley floor, and generally indicate a direction of groundwater flow parallel to Alameda Creek. As indicated in Figure 5.4.4-1, groundwater levels are lowest at the northwestern end of the valley, near the Sunol Water Temple, and are highest in the southern, upper end of the Sunol Valley. Groundwater was thus determined to flow in a northwesterly direction, with a focus at the entrance to Niles Canyon.

Geomatrix Consultants measured levels in the three groundwater monitoring wells installed in the shallow alluvium deposits (to an approximate depth of 25 feet) and in Alameda Creek above Sunol Dam between April 2004 and April 2005 (San Francisco Planning Department, 2005). The data indicate a steady decline in groundwater levels adjacent to Sunol Dam (approximately 300 feet from the dam) over the summer months (a 5- to 6-foot decline in six months). As noted above, Sunol Dam was recently removed, which eliminates its influence on groundwater levels and is projected to lower those levels by about 5 feet in the vicinity of the dam.

Groundwater between Interstate 680 and the entrance to Niles Canyon flows to the northwest, gradually sweeping to a southwest flow direction in the immediate vicinity of Sunol Dam (see Figure 5.4.4-1). The presence and flow direction of groundwater is complicated by the infiltration galleries, stream confluences, and, formerly, the Sunol Dam. Comparison of ground surface contour values with the inferred water table surface suggests that Alameda Creek is a “losing” waterway for the majority of its course through the Sunol Valley (i.e., water from Alameda Creek recharges the groundwater table via infiltration through the streambed). However, in the vicinity of the confluence between Arroyo de la Laguna and Alameda Creek, this recharge relationship reverses, with groundwater beginning to contribute to Alameda Creek flow. This portion of Alameda Creek is thus classified as a “gaining” stream. By Sunol Dam, groundwater to creek discharge is well established.

Groundwater in the northwesternmost portion of the Sunol Valley is recharged to a large degree by flow from Arroyo de la Laguna. Arroyo de la Laguna, as it crosses the Sunol Valley on its way to the confluence with Alameda Creek, recharges the general groundwater table to the northwest, and the general groundwater table and infiltration galleries to the southeast. In this capacity, Arroyo de la Laguna has the potential to act as an intermediate sub-groundwater divide.

Groundwater in Niles Canyon

The local hydrogeology in Niles Canyon is best envisioned as occurring in two separate and distinct geological units. The broader, and from a resource perspective, lesser aquifer is contained within the Panoche Formation bedrock. The other aquifer is hosted in alluvial deposits immediately beneath and adjacent to Alameda Creek. The alluvial deposits form the floodplain adjacent to the creek; however, the floodplain is limited in extent by the bedrock slopes of Niles Canyon.

The shallow alluvial aquifer system is well connected to surface water in Alameda Creek. It is reasonable to assume that the amount of groundwater in the shallow aquifer is dependent on the water level in Alameda Creek, and that there is a shallow groundwater gradient directing flow toward Alameda Creek. The shallow groundwater gradient could change on a short-term basis as the limited aquifer responds to precipitation and recharge of shallow groundwater, and as the water level in Alameda Creek fluctuates. The range of seasonal groundwater fluctuation at the site of Niles Dam is expected to be about 1 to 3 feet. The floodplain at Niles Dam was slightly elevated from the water table year-round, producing a condition that may help support a riparian community. Niles Dam was removed in September 2006. The removal of this dam is expected to slightly lower groundwater levels.

The bedrock is not considered a significant aquifer host due to the expected low yields. Furthermore, groundwater in the bedrock would not be strongly influenced by changes and fluctuations in Alameda Creek hydrology, as the hydraulic connection between the two is likely limited.

Groundwater Quality

Groundwater within the Sunol Valley area is calcium-magnesium bicarbonate water, with concentrations of individual constituents at generally low levels. Total dissolved solids are low (from about 350 to 500 mg/L), as are nitrate concentrations (from 1 to 6 mg/L), with the exception of some localized and elevated nitrate and total dissolved solids concentrations in shallow groundwater due to historical agricultural practices (Bookman-Edmonston Engineering, Inc., 1995).

5.4.4.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to groundwater, but generally considers that implementation of the proposed program would have a significant groundwater impact if it were to:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)
- Substantially impair a water body's ability to support beneficial uses designated by the State Water Resources Control Board or Regional Water Quality Control Board
- Otherwise substantially degrade water quality

Approach to Analysis

Information on potentially affected groundwater bodies was obtained from published sources and through interviews with individuals who are knowledgeable about the hydrogeology of the area or involved with groundwater management in the potentially affected area. Impact assessments were performed by reviewing WSIP-induced changes in stream flow and examining their potential to affect groundwater levels or quality.

Impact Summary

Table 5.4.4-1 presents a summary of the impacts on groundwater bodies in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

**TABLE 5.4.4-1
SUMMARY OF IMPACTS –
GROUNDWATER BODIES IN THE ALAMEDA CREEK WATERSHED**

Impact	Significance Determination
Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies	LS

LS = Less than Significant impact, no mitigation required

Impact 5.4.4-1: Changes in groundwater levels, flows, quality, and supplies.

Compared to current conditions, increased diversions and storage under the WSIP would reduce peak flows in Alameda Creek between the diversion dam and the confluence with San Antonio Creek. Seasonally, the WSIP would reduce flows in the high-flow months and increase flows in the low-flow months due to fishery releases. It would also increase storage in Calaveras Reservoir. The overall effect of these changes in groundwater supplies downstream in the Sunol aquifer areas is expected to be minor (either slightly positive or slightly negative), depending on the year's rainfall and seasonal conditions. The WSIP would reduce potential infiltration in the Sunol groundwater basin by reducing peak flows in wet years. Impacts on groundwater in the Niles Cone would be less than significant because flows in Alameda Creek downstream of Niles Canyon would be maintained within the range of flows experienced since the Niles Cone began to be managed and utilized as a water supply resource. The program's minor changes in groundwater levels would not affect groundwater quality. This impact would be *less than significant*, and no mitigation measures would be required.

References – Groundwater

Bookman-Edmonston Engineering, Inc., prepared for San Francisco Water Department, *Alameda Creek Water Resources Study*, Appendix A-5 of the *Alameda Watershed Management Plan*, 1995.

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San Francisco Public Utilities Commission (SFPUC), Sunol Filter Beds and Pleasanton Well Field. Available online at http://sfwater.org/printContent.cfm/C_ID/797/, accessed January 11, 2005, Drawing F-342A, Niles Canyon Properties Sunol Portion, May 1960.

5.4.5 Fisheries

The following setting section describes the fishery resources within the streams and reservoirs of the Alameda Creek watershed that could be affected by the WSIP. The impact section (Section 5.4.5.2) provides a description of the effects of WSIP-induced changes in stream flow and reservoir levels on fishery resources.

5.4.5.1 Setting

Alameda Creek and some of its major tributaries historically contained populations of anadromous steelhead and resident rainbow trout (*Oncorhynchus mykiss*) that supported a local recreational fishery. As described below, water supply projects, gravel mining, urban development, and flood control modifications have reduced this historical fishery; however populations of these and other fish species still inhabit certain reaches of Alameda Creek and its tributaries.

Aquatic Habitats

Alameda Creek flows from its headwaters at Oak Ridge to South San Francisco Bay. The creek has historically been divided into three distinct reaches: upper Alameda Creek and its tributaries, Niles Canyon reach and tributaries such as Arroyo del la Laguna, and lower Alameda Creek. Alameda Creek is characterized by long runs and glides and relatively short, shallow riffles (Hanson Environmental, 2002a). Alameda Creek and its tributaries have highly variable seasonal streamflows (see Section 5.4.1 for further description of stream flow).

The substrate ranges from silt and sand with small cobbles to gravel and larger boulders. The lower reach of the creek is characterized by extensive urban development and has been channelized (rip-rapped) for floodwater conveyance. Portions of Alameda Creek are shaded by mixed riparian forest at the margins of the creek. This vegetation is extensive in the Niles Canyon reach, where it occupies the first terrace from the edge of the creek (i.e., ordinary high water) to approximately 6 to 8 feet above ordinary high water (San Francisco Planning Department, 2005).

Flows in the mainstem Alameda Creek and its tributaries are flashy with high flows during the winter and spring and low flows during the summer and fall. In the past, portions of Alameda Creek, particularly the Niles Canyon, Sunol Valley, and lower reach have had low and intermittent streamflows during the summer of dry years. Similar intermittent stream flow conditions have occurred in the tributaries, with the greatest frequency of intermittent flows occurring in the lower elevation alluvial sections during dry years. The seasonal hydrology of Alameda Creek has changed over the past several decades with the addition of upstream storage reservoirs and flow augmentation from managed releases from the State Water Project's South Bay Aqueduct for groundwater recharge and deliveries to local urban communities.

In addition, major alterations to the creek and its tributaries, including the channelization of the lower 12 miles of the creek for flood control; the construction of San Antonio, Calaveras, and Del Valle Reservoirs for water supply; and the construction of a concrete drop structure to stabilize the channel around the Fremont BART weir have made spawning habitat within the watershed inaccessible for some returning anadromous fishes such as steelhead and Chinook salmon (*Oncorhynchus tshawytscha*) (Gunther et al., 2000).

Upper Alameda Creek

Upper reaches of Alameda Creek include higher elevation steeper gradient stream reaches typically bordered by riparian vegetation. Summer water temperatures are typically cooler than those observed further downstream. Bedrock outcroppings influence channel features in several areas including the Little Yosemite reach. The upper reach supports a reproductive population of resident rainbow trout.

Niles Canyon

Prior to the development of water conveyance facilities, Alameda Creek in Niles Canyon was likely an intermittent to perennial stream characterized by low flows during late summer and fall. Aquatic habitats within Niles Canyon likely functioned as a migratory corridor for anadromous fishes such as steelhead and Pacific lamprey (*Petromyzon marinus)* (Gunther et al., 2000). SFPUC fishery monitoring has documented successful lamprey spawning and rearing within Niles Canyon in recent years (ACA, 2004). However, construction and operation of dams, diversions, and other structures that function as fish migration barriers (e.g., the Sunol and Niles Dams and the grade control structure at the BART weir) have prevented anadromous fishes such as steelhead migrating into Alameda Creek and through Niles Canyon from reaching coldwater habitat further upstream within the watershed (Gunther et al., 2000). The Sunol and Niles Dams were partially removed in September 2006, eliminating them as obstacles to fish passage.

The Alameda County Water District (ACWD) augments summer flows, particularly summer releases from Del Valle Reservoir through Arroyo de la Laguna into Niles Canyon. Although the stream temperatures within the reach are probably higher than predevelopment flows, augmented flows potentially provide atypical fast-water habitat that may provide habitat and food for native and non-native fishes. Thus, some evidence suggests that suitable steelhead/rainbow trout habitat occurs in Niles Canyon (Gunther et al., 2000; Smith, 1999; and McEwan, 1999). Results of water temperature monitoring within the Niles Canyon reach of Alameda Creek during 2001-2002 (Hanson Environmental, 2002) showed summer temperatures in excess of 75 °F which would significantly affect the ability of juvenile and adult steelhead/rainbow trout to oversummer within the canyon reach. Monitoring conducted by Hanson Environmental in 2001 and 2002 also shows that water in Alameda Creek is in thermal equilibrium by the time it flows to the Niles Canyon reach of the river, likely due to the prolonged solar warming occurring from the Sunol Regional Wilderness to the Niles Canyon reach. More suitable summer water temperatures were observed further upstream.

Arroyo de la Laguna, Arroyo Mocho, and Arroyo Valle

Arroyo de la Laguna, Arroyo Mocho, and Arroyo Valle are major tributaries to Alameda Creek that drain watersheds in the Livermore-Amador Valley. These tributary creeks are characterized by highly variable seasonal hydrology. Land use changes over the past 150 years have substantially altered the characteristics and hydrology of these creeks. The creeks have been modified to provide flood control capacity within the urbanized areas of the valley and are also used for water conveyance and groundwater recharge. Arroyo Valle and Arroyo Mocho historically supported resident trout fisheries in the upper watersheds, primarily through routine fingerling plantings from hatcheries including the Mount Whitney Hatchery. Adult steelhead were periodically caught in Arroyo Valle and lower Alameda Creek, although the occurrence of records of adult steelhead in Arroyo Valle suggests that only a small number of fish may have occurred (on an infrequent basis) within this portion of the watershed, periodically under favorable environmental and hydrologic conditions (Hanson et al., 2004). No records of adult steelhead being caught by recreational anglers were found for Arroyo Mocho. It is unlikely that either watershed historically provided consistent suitable habitat conditions for steelhead passage, spawning, and/or juvenile rearing to support self-sustaining populations. Arroyo Mocho channel form would have made adult steelhead migration unlikely prior to channelization based upon historic geomorphic conditions within the lower reaches of the Arroyo Mocho channel. Historically, steelhead passage in Arroyo Valle occurred infrequently, in response to high flow events that provided suitable surface water connectivity between Arroyo Valle and lower Alameda Creek.

Arroyo Hondo

Arroyo Hondo, a tributary to Calaveras Creek upstream from Calaveras Reservoir, is known to contain self-sustaining populations of resident rainbow trout. These resident trout populations may have been derived from coastal steelhead trapped in the upper watershed after Calaveras Dam was constructed (Gunther et al., 2000). The trout spawn and rear in the lower mile of Arroyo Hondo, and then some return to Calaveras Reservoir or remain in Arroyo Hondo where they reside for the rest of the year (Entrix, 2003; SFPUC, 2003). Spawning habitat for the reservoir population may be limited by a historic landslide that prevents upstream migration and spawning at locations more than one mile upstream from Calaveras Reservoir (SFPUC, 2004). Resident rainbow trout also successfully spawn and rear in Arroyo Hondo upstream of the landslide.

Currently, the SFPUC conducts two annual fishery monitoring projects in Arroyo Hondo, an expanded aquatic resource monitoring project, and a predation study. The SFPUC plans to begin a reservoir trout population size study in 2007.

Lower Alameda Creek

The lower reach of Alameda Creek is characterized by in stream pools formed by inflatable rubber dams used to convey water from the creek into lateral gravel quarry pits used for groundwater recharge by ACWD. The rubber dams are typically deflated during periods of high flows and increased turbidity. Substrate is typically fine sand and silt. Summer water temperatures are relatively high. The reach provides habitat for warmwater fish such as largemouth bass. The lower 12 miles of the creek is primarily managed as a flood control facility. The channel is armored by riprap. Sediment removal and channel regrading is periodically required to maintain flood conveyance capacity.

Steelhead/Rainbow Trout

Regulatory Status

Steelhead/rainbow trout[1] is a federally listed threatened species (NMFS, 2006). Critical habitat, which was designated for this species by the National Marine Fisheries Service (NMFS) in February 2000, included the Alameda Creek watershed. However, in April 2002 NMFS withdrew the critical habitat designation pending further economic impact analysis (NMFS, 2002). In September 2003, the NMFS formally withdrew the critical habitat designation for the Central California Coast ESU as well as 18 other ESUs (NMFS, 2002). In June 2004, the NMFS proposed including resident rainbow trout in the Central California Coast ESU due to genetic similarities between resident and migratory trout within the Alameda Creek watershed upstream of ACWD Rubber Dam 1 (NMFS, 2004). The NMFS subsequently determined that resident rainbow trout inhabiting Alameda Creek should not be included in the ESU for anadromous steelhead (NMFS, 2006). Instead, NMFS determined to list as threatened only those rainbow trout/steelhead that exist below the lowest impassible barriers in the Alameda Creek watershed (i.e., the BART Weir). Thus, the resident rainbow trout that occur in the creek above the BART Weir are not designated as a listed species.

The SFPUC would be required to obtain a Clean Water Act Section 404 permit from the US Army Corps of Engineers (USACE) to construct the Calaveras Dam Replacement project (SV-2) downstream of the existing dam. Before issuing a Section 404 permit, the USACE is required under Section 7 of the ESA to consult with NMFS and the USFWS on designated species to obtain a biological opinion of no jeopardy and an incidental take statement. NMFS also advised the SFPUC that while the USACE would need to initiate a Section 7 consultation with NMFS on the Calaveras Dam Replacement project, it was unlikely that operation of Calaveras Dam would adversely affect steelhead in the area below the BART Weir by making conditions unsuitable for successful steelhead spawning, egg incubation, or juvenile rearing. For this reason, NMFS advised that the steelhead issues above the BART Weir would not be addressed in the Calaveras Dam Replacement project Section 7 consultation, and that incidental take coverage for steelhead in the upper watershed would have to be obtained through a habitat conservation plan (HCP) or through a re-initiated USACE consultation on the Calaveras Dam Replacement project after the lower passage problems are remedied.

Life History

O. mykiss have a dynamic life history. All *O. mykiss* hatch in the gravel substrate of coldwater streams. After hatching, the young fry emerge from the gravel and start feeding in the stream. Some begin to disperse downstream in the months following their emergence, but most continue to rear in the stream. Following a rearing period of at least one year, juveniles follow a variety of life-history patterns, including residents (nonmigratory) at one extreme and individuals that migrate to the open ocean (anadromous) at another extreme. Intermediate life-history patterns include fish that migrate within the stream (potamodromous), fish that migrate only as far as estuarine habitat, and fish that migrate to near-shore ocean areas.

[1] Rainbow trout and steelhead are the same species of trout (*O. mykiss*). The freshwater variety are rainbow trout, and trout that migrate from the ocean to spawn in freshwater (i.e., anadromous) are steelhead.

Juveniles that become migratory typically do so after one or two years of rearing, but sometimes longer. Physiological changes in these fish (called smolts) ultimately allow them to make a transition from freshwater to seawater. Smolts migrate to the ocean, spend a variable amount of time there (typically one to two years), grow rapidly, and return to spawn, generally in the stream where they hatched. Steelhead are unusual among the other Pacific salmonids in that they do not all die after spawning. Some return immediately to the ocean, and others return after holding for a period in freshwater. Within a given stream, some *O. mykiss* do not migrate to the sea, and the proportion may vary considerably depending on local circumstances. These fish reach sexual maturity and spawn without entering the ocean and are often known as resident or stream rainbow trout (Gunther et al., 2000).

Anadromous steelhead exhibit two basic life-history forms. Stream-maturing steelhead enter spawning streams before they are sexually mature, generally during the period between spring and early fall, and spend several months in the stream before they are ready to spawn. Ocean-maturing steelhead enter spawning streams during the fall and winter in a fully mature state and spawn relatively soon after entering freshwater (Gunther et al., 2000). Both forms may occur in the same river system with little or no genetic distinction. Details on the life history of steelhead inhabiting the Alameda Creek watershed are unknown, however the low summer flows and seasonally elevated water temperatures within many of the reaches may have limited opportunities for stream-maturing adult steelhead to have successfully oversummered in many areas. Steelhead habitat requirements are associated with distinct life-history stages, including migration from the ocean to inland reproductive and rearing habitats, spawning and egg incubation, rearing, and seaward migration of smolts and spawned adults. Habitat requirements and life-history timing can vary widely over the steelhead's natural range (Barnhart, 1986; Pearcy, 1992; and Busby et al., 1996; cited in Gunther et al., 2000).

Resident and Migratory Populations

Populations of resident rainbow trout have been reported above the Calaveras Reservoir on several occasions since 1905, in Arroyo Hondo, Isabel Creek, and Smith Creek (Leidy, 1984). Young-of-year *O. mykiss* have been observed in Stonybrook Creek and Sinbad Creek, tributaries to Alameda Creek (Gunther et al., 2000). However, electrofishing in Sinbad Creek in 1997 and 1998 failed to capture any *O. mykiss*. Stonybrook Creek is regarded as potential *O. mykiss* habitat based on the presence of several age classes of resident individuals, including young-of-year (Gunther et al., 2000).

There is some evidence that a native, locally adapted *O. mykiss* stock survives in the Alameda Creek watershed (Gunther et al., 2000). Resident rainbow trout were collected below Niles Dam in 1927 and in Stonybrook Creek, a tributary to Alameda Creek, in 1955. Sampling by the ACWD in 1999 documented the presence of reproducing populations of resident trout in Arroyo Mocho and two tributaries to Alameda Creek, Welch and Pirate Creeks (Buchan et al., 1999). Recent sampling by the East Bay Regional Park District documented the presence of reproducing trout populations in Stonybrook Creek and Alameda Creek in the Sunol Regional Wilderness (Leidy, 2003).

Sightings of migratory steelhead have been reported downstream of the BART weir. In recent years, individual steelhead were captured near the BART weir by citizen groups and released at the mouth of Niles Canyon upstream of the ACWD inflatable diversion dams. One of these fish, a pregnant female, was tracked to Stonybrook Creek, upstream of Niles Dam (Gunther et al., 2000). There are also reports of migratory steelhead spawning in Alameda Creek downstream of the middle inflatable dam, and in 1998 fertilized eggs were collected from the area immediately downstream of the BART weir. The eggs hatched successfully, and the resulting fry were released into Alameda Creek in Sunol Park (Gunther et al., 2000).

Genetic testing by Nielson (2003) was based on a small sample size, but suggests that the present self-sustaining populations of resident rainbow trout may have been derived from migratory steelhead that were isolated in the upper part of the watershed by natural processes or by construction of Calaveras Dam (NMFS, 2004). The presence of migratory barriers, notably the BART weir, prevents upstream movement of migratory steelhead.

Temperature is an important factor affecting habitat quality and availability for migratory and resident trout, particularly during the oversummer rearing period (Gunther et al., 2000; Hanson Environmental 2002b). Temperature in Alameda Creek is discussed in Section 5.4.3. The upper lethal temperature for Pacific salmonids is in the range 23.9 to 25 °C for continuous long-term exposure (Gunther et al., 2000). Some researchers indicate an upper lethal temperature for Pacific salmonids as low as 22.9 °C (Hanson, 2003); however, steelhead can survive for short periods at elevated temperatures, especially if abundant food and dissolved oxygen exists. Recent temperature data suggest that summer and early-fall temperatures in Niles Canyon are within the range considered to be highly stressful or unsuitable for juvenile steelhead (Hanson Environmental, 2002b).

Spawning

The presence of self-sustaining resident rainbow trout populations with multiple age class structure within the watershed provides evidence of consistent successful reproduction (Gunther et al., 2000). The best potential spawning (and rearing) habitat in the watershed exists in the upper reaches of Alameda Creek, upstream tributaries, and the Arroyo Mocho canyon.

Steelhead/rainbow trout, like all Pacific salmon, select spawning sites with specific features. These features include gravel substrate with sufficient flow velocity to maintain circulation through the gravel and provide a clean, well-oxygenated environment for incubating eggs. Preferred gravel substrate is in the range of 0.25 to 2.5 inches in diameter, and flow velocity is in the range of 1 to 3 feet per second. Steelhead will use substrate with larger gravel (up to 4 inches) than will resident trout. Sites with preferred features for spawning occur most frequently in the pool tail/riffle head areas, where flow accelerates out of the pool into the higher gradient section below. In such an area, the female steelhead will create a pit, or redd, by undulating her tail and body against the substrate. This process also disturbs fine sediment in the substrate and lifts it into the current to be carried downstream, cleaning the nest area. Survival of fertilized eggs through hatching and emergence from the gravel is most often limited by radical changes in flow that can dislodge eggs from the substrate, result in sedimentation, or dewater incubation sites (Gunther et al., 2000).

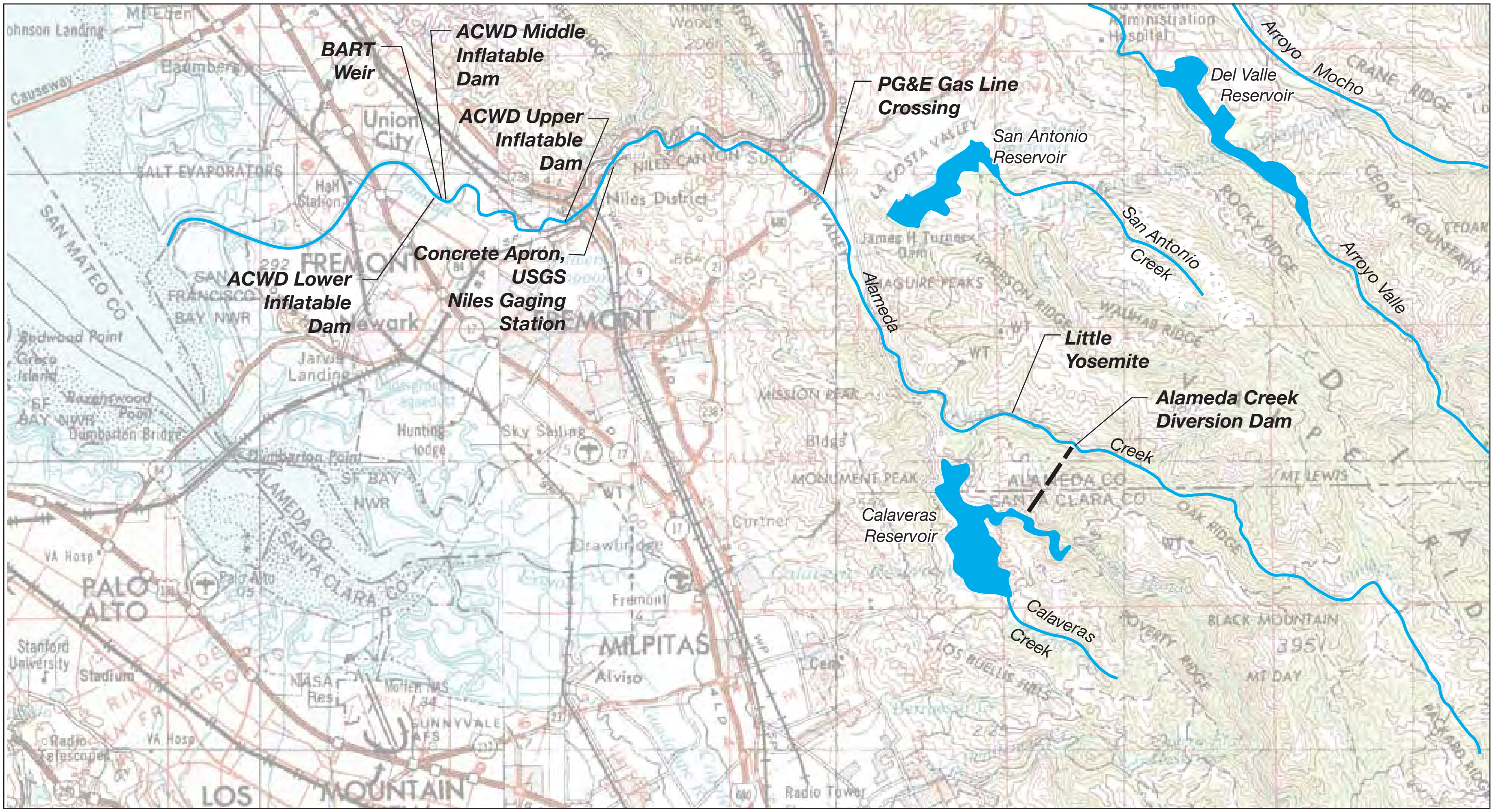
Areas of the watershed that support resident trout all show evidence of successful spawning, as indicated by the presence, abundant in places, of young-of-year trout. Suitable substrate conditions for spawning and egg incubation are found at some level in all stream reaches potentially supporting steelhead. Given the high potential fecundity of steelhead, factors other than availability of spawning habitat are likely to be more limiting; however, reconnaissance surveys conducted to date are not of sufficient detail to quantify the overall extent and quality of suitable substrate (Gunther et al., 2000). It is possible that more detailed observations would reveal opportunities for improving spawning habitat and enhancing production of steelhead juveniles. However, the availability of spawning habitat does not appear to preclude steelhead from completing their life cycle in the Alameda Creek watershed (Gunther et al., 2000).

Juvenile Rearing

Rearing habitat is limited in most of the areas potentially supporting steelhead by low summer stream flow and exposure to seasonally elevated water temperatures (Gunther et al., 2000). This natural condition under which steelhead in these reaches evolved has been exacerbated by urban development. However, areas exist with suitable water temperature for rearing *O. mykiss*, particularly in the upper canyon reaches of the creek and larger tributaries (Gunther et al., 2000; Hanson Environmental 2002b). In some of the stream reaches supporting the greatest numbers of resident trout, low summer stream flow results in relatively small, infrequent, isolated pools (e.g., the reach of Alameda Creek located upstream and downstream of the diversion dam). More pools or larger pools would be expected to allow greater numbers of trout to survive the low-flow period (Gunther et al., 2000), but this is a natural condition in these reaches and one to which steelhead/rainbow trout have adapted. Availability of late-summer habitat may limit the abundance of steelhead/rainbow trout within the watershed, but it does not preclude them from completing their life cycle (Gunther et al., 2000).

Rainbow Trout/Steelhead Migration and Barriers

As described above, Alameda Creek historically hosted a steelhead run, with spawning occurring in the upper reaches of the watershed. That steelhead run was eliminated by the placement of several obstructions to migration within the Alameda Creek channel over the past century. These obstructions include the Alameda County Flood Control and Water Conservation District's BART Weir located about 9.5 miles upstream from the creek's confluence with San Francisco Bay; Alameda County Water District (ACWD) rubber dams (ranging in location from about two miles upstream of the Bay to just below Niles Canyon), the USGS gaging station weir in Niles Canyon, and the PG&E drop structure in the Sunol Valley (see **Figure 5.4.5-1**). In addition, the Calaveras, San Antonio, and Alameda Creek Diversion Dams (all owned by the City and County of San Francisco and operated by the SFPUC) and Del Valle Dam (owned and operated by the California Department of Water Resources) are all impassable barriers in the upper part of the watershed. The SFPUC removed above-ground portions of two relict diversion dams located on the creek (Sunol Dam and Niles Dam) in September 2006. Other migration barriers along the creek also have been or are in the process of being removed: two swimming hole dams in the Sunol Regional Wilderness park were removed in the past few years; and the ACWD is



0 10
Miles

SOURCE: ESA + Orion; USGS 1969

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Figure 5.4.5-1
Potential Barriers to Fish Migration in Alameda Creek Watershed

evaluating plans to remove or provide fish passage at their rubber dams and is currently installing a positive barrier fish screen on an unscreened diversion from the creek.

Despite the recent removal of these structures, currently, steelhead can migrate upstream only as far as the BART Weir. Since 2000, up to seven fish have been found at the base of the BART Weir annually during the migration season. (The area below the weir is monitored by the Alameda Creek Alliance for migrating fish). When found, these steelhead are collected, transported upstream, and released into the creek near Niles Canyon where several have been observed migrating upstream into tributary creeks. The NFMS rule regarding the listing of Alameda Creek steelhead as threatened under the Federal ESA (California Central Coast Distinct Population Segment), finalized in January 2006, applies only to the anadromous form of *O. mykiss* and therefore is limited to populations below the BART Weir.

Steelhead will not have unimpeded access to the upper Alameda Creek Watershed until passage is provided at the remaining downstream barriers to fish migration. The locations of passage barriers within the watershed are shown in Figure 5.4.5-1. These barriers and the status of planning to address passage at these locations is described below:

- Alameda County Flood Control and Water Conservation District’s BART Weir – several studies have been conducted regarding potential designs to provide passage at this location. The most recent effort is a report (Wood Rogers, 2006) that outlines options ranging from total removal of the structure (“roughened channel”) to three ladder and screen alternatives. The range of low flows estimated to allow suitable passage for adult steelhead among these four options is 10–50 cfs. However, other barriers (e.g., ACWD middle and upper rubber dams, PG&E Drop Structure – see below) within Alameda Creek may be impassable at these low flows. On July 31, 2007, the Alameda County Flood Control and Water Conservation District and the ACWD entered into an agreement to design a fish passage facility over the BART weir and the middle inflatable dam in the Alameda County Flood Control Channel to improve steelhead passage within the Alameda Creek watershed.

- ACWD middle and upper rubber dams – design of fish passage options and/or operational changes are being studied. There is currently no schedule or budget, and environmental review has yet to begin. (CH2MHill, 2001)

- USGS Niles gaging station weir/concrete apron – has been identified as potential barrier (passage impediment) at some flow levels. The Northern California Council Federation of Fly Fishers (NCCFFF) has developed a preliminary study (Federation of Fly Fishers, 2004), which includes a preliminary finding that the apron/weir fails to comply with existing fish passage criteria and would be a severe impediment to upstream migration of steelhead. However, this conclusion has been questioned by other experts, and NCFFF is continuing its studies.

- PG&E Drop Structure – protects a natural gas pipeline under the creek. No studies have been conducted to date regarding fish passage options, and there is no schedule or budget for this project. The SFPUC proposed to coordinate planning for a passage project at this location with PG&E in its Sunol Valley Quarry request for proposals. The SFPUC has yet to make a selection from those responding to the RFP, but the selected entity will be required to provide funds towards this effort.

- The SFPUC’s Alameda Creek Diversion Dam could block migration to any migrating steelhead that travel upstream of the Little Yosemite area.

- A number of low-flow passage impediments exist within Alameda Creek including shallow riffles, short falls and bedrock plunge pools, and other small structures.

The SFPUC also is conducting preliminary studies of passage issues in the watershed: (1) natural barriers in the watershed, including the landslide in the Arroyo Hondo above Calaveras Reservoir, and the Little Yosemite reach of Alameda Creek; (2) Calaveras Dam; (3) Alameda Creek Diversion Dam; and (4) critical riffles on Alameda Creek, focusing on the Sunol Valley/Quarry reach.

In addition, the Calaveras, San Antonio, and Alameda Creek Diversion Dams (all owned by the City and County of San Francisco and operated by the SFPUC) and Del Valle Dam (owned and operated by the California Department of Water Resources) are all impassable barriers in the upper part of the watershed. The SFPUC removed above-ground portions of two relict diversion dams located on the creek (Sunol Dam and Niles Dam) in September 2006.

Flows to Support Rainbow Trout/Steelhead

In addition to migration barriers, reduced winter and spring flows in Alameda Creek above the BART Weir also would limit migration and spawning if steelhead were to gain access upstream. The Alameda Creek Fisheries Restoration Workgroup (Workgroup), formed for the purpose of restoring steelhead to Alameda Creek, will be undertaking a series of flow studies to determine the flows necessary to support steelhead in the watershed. The Workgroup includes the SFPUC, Alameda County Flood Control and Water Conservation District, Alameda County Resource Conservation District, ACWD, Alameda Creek Alliance, California State Coastal Conservancy, California Department of Fish and Game, East Bay Regional Park District, National Marine Fisheries Service (NMFS), Natural Resources Defense Council, Pacific Gas and Electric Company (PG&E), and the Zone 7 Water Agency (Zone 7).

These agencies developed a Memorandum of Understanding (MOU) in April 2006 that describes the commitment and process to jointly fund and conduct flow studies to estimate the range, magnitude, timing, duration, frequency and location of flows necessary to restore steelhead within the creek, while also considering other native fishes and riparian communities, in the Alameda Creek watershed while minimizing the potential impacts to agencies responsible for supplying drinking water to Bay Area communities. In December 2006, a consultant was selected to manage the flow studies.

These flow studies are intended to result in a flow strategy that will meet with approval from the state and federal regulatory agencies and satisfy regulatory requirements. This strategy, when combined with other aspects of a fisheries restoration program, is intended to provide long-term assurances and certainties for restoring and maintaining native fishes, as well as providing water agencies and other utilities and special districts with long-term assurances and certainties for continued water supply and other infrastructure operations in the watershed. The flow studies are being conducted in three phases:

Phase 1 will include a review of relevant existing information on hydrologic and geomorphic conditions and fish habitat in the watershed. Based on this foundation, the Workgroup will agree on a detailed work plan for the tasks needed to estimate the range, magnitude, timing, duration, frequency and location of flows necessary to restore a population of steelhead to the creek (while also considering their effects on other native fishes and riparian communities). That work plan, scheduled to be completed by June 2007, will be conducted in the second phase of the studies.

Phase 2 will focus on developing a common understanding of the existing conditions in the watershed and collecting the additional data necessary to estimate the flows needed to restore steelhead in the Alameda Creek watershed. This assessment will be based on the review of existing hydrologic and geomorphic conditions and the estimated flows needed to support steelhead throughout their lifecycle in the watershed. Results from Phase 2 will form the foundation from which flow proposals that will support steelhead can be developed and analyzed. The Workgroup currently anticipates that Phase 2 will be completed by January 2009.

The scope and schedule for Phase 3 will be determined following completion of Phases 1 and 2, and is expected to include the development and analyses of specific flow alternatives, including operational, engineering, and natural resource strategies, with the intent of achieving the restoration goals identified in Phase 2.

The SFPUC plans to incorporate these strategies into its Alameda Watershed Habitat Conservation Plan, which will provide coverage for regional water system operations within the Alameda Creek Watershed under the Federal Endangered Species Act (ESA, Section 10) for covered species, including steelhead.

The design of the fish passage projects, particularly for the BART Weir and the ACWD rubber dams, would be closely coordinated with the Workgroup's flow studies. Passage alternatives range from total removal of barriers to ladder/screen construction projects, and the flows required to provide passage at different times of the year would vary widely until a specific design is selected for each location. It is also critical for these designs to be considered in the context of existing and future water supply operations by ACWD, SFPUC, and Zone 7.

Potential Steelhead Restoration

For the purposes of full disclosure, the PEIR provides this discussion of steelhead in lower Alameda Creek, and the potential for steelhead to be restored to the upper reaches of Alameda Creek (above the BART weir). However, because this steelhead access does not currently exist and there is no current steelhead migration above the BART weir, the potential impact on steelhead migration, spawning, or juvenile rearing upstream of the BART weir as a result of WSIP implementation is not analyzed in this section, which addresses WSIP impacts relative to existing conditions, but instead is analyzed as a future, cumulative impact in Section 5.7.3.

[Additional discussion on steelhead fishery in Alameda Creek was prepared in response to comments on the Draft PEIR. Please refer to Section 14.9, Master Response on Alameda Creek Fishery Issues (Vol. 7, Chapter 14).]

Other Fish Species

Chinook Salmon

Chinook salmon remains within archaeological sites in the lower Alameda Creek floodplain (Gunther et al., 2000). These fish could have been captured in San Francisco Bay or other locations and transported to the site. Historically, Alameda Creek could have supported small runs of Chinook salmon, as have been observed in other South Bay tributaries. In recent years, small numbers of Chinook salmon adults have been recovered from the Alameda Creek flood control channel downstream of the BART weir, as well as from other streams tributary to South San Francisco Bay that were not previously known to support salmon runs. It is generally believed that management of hatchery production has resulted in salmon straying to streams that have not traditionally supported them (Gunther et al., 2000).

Other Species

Approximately seventeen native fish species have been collected in nontidal portions of the Alameda Creek watershed during the past century (**Table 5.4.5-1**). Several other species may also have occurred in the watershed based on collections in tidal portions, evidence from archaeological investigations, and other accounts. Many collections include widely distributed species typical of streams in the region, such as California roach (*Hesperoleucus symmetricus*), hitch (*Lavinia exilicauda*), Sacramento sucker, Sacramento pikeminnow (*Ptychocheilus grandis*), steelhead/rainbow trout, Pacific lamprey (*Lampeta tridentata*), and prickly sculpin (*Cottus asper*) (Gunther et al., 2000). Two species, speckled dace (*Rhinichthys Osculus*) and riffle sculpin (*Leptocottus armatus*), have appeared in only one or two collections. Speckled dace were reported to occur in Arroyo Hondo and Isabel Creek (two Calaveras Creek tributaries above Calaveras Reservoir) by Snyder in 1905, and in Alameda Creek at the confluence with Calaveras Creek by Shapovalov in 1938 (Leidy, 1984).

In surveys conducted between 1972 and 1977, Scoppettone and Smith (1978; Gunther et al., 2000) did not find speckled dace in these areas. Riffle sculpin collected in Alameda Creek at the junction with Calaveras Creek in 1938 by Shapovalov (Gunther et al., 2000) is the only report of the species in the Alameda Creek watershed. Scoppettone and Smith (1978) sampled for riffle sculpin at sites with cool, permanent water in Isabel, Smith, Arroyo Hondo, Arroyo Mocho, and Alameda Creek, but found none. Of the 15 remaining species, all were collected as recently as 2002 (Leidy, 2007). The SFPUC has also conducted an annual fishery survey within the watershed since 1998.

The two species not collected in 1981 were Pacific lamprey and Sacramento blackfish (Gunther et al., 2000). Pacific lamprey have been recently netted in the flood control channel section. Sacramento blackfish have been reported in the ACWD quarry lakes. Sacramento perch, one of the species collected in 1981, are native to California. Aceituno et al. (1976) believed that Sacramento perch were stocked in Calaveras Reservoir some time after 1925 and spread to the stream from there. However, Gobalet (1990) reports Sacramento perch from fish remains at an archaeological site adjacent to Arroyo de la Laguna. In any case, the species has been collected in Niles Canyon since 1953 and currently maintains populations in the off-channel percolation ponds adjacent to the flood control channel (Gunther et al., 2000).

[Additional discussion on other fish species and aquatic habitat in Alameda Creek was prepared in response to comments on the Draft PEIR. Please refer to Section 14.9, Master Response on Alameda Creek Fishery Issues (Vol. 7, Chapter 14).]

TABLE 5.4.5-1
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name *Scientific Name*	**1905 Synder**	**1927 Follet**	**1934 Seale**	**1938 Shapovalov**	**1953 Follett**	**1955 Follett**	**1957–1958 Follett**	**1961 Hopkirk**	**1972 Follet**	**1973 CDFG**	**1977 Scoppettone and Smith**	**1984 Leidy**	**2007 Leidy**
Native Species													✓
Pacific lamprey (*Petromyzon marinus*)						✓	✓			✓			✓
California roach (*Hesperoleucus symmetricus*)	✓		✓				✓	✓			✓	✓	✓
Hitch (*Lavinia exilicauda*)	✓		✓			✓			✓	✓		✓	✓
Sacramento blackfish (*Orthodon microlepidotus*)			✓			✓	✓	✓	✓	✓			✓
Sacramento squawfish (pikeminnow) (*Ptychocheilus grandis*)	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
Speckled dace (*Rhinichthys Osculus*)				✓									
Sacramento sucker (*Catostomus occidentalis*)	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
Steelhead/rainbow trout (*Oncorhynchus mykiss*)		✓				✓	✓				✓		✓
Threespine stickleback (*Gasterosteus aculeatus*)			✓							✓		✓	✓
Sacramento perch (*Archoplites interruptus*)					✓	✓	✓		✓	✓	✓	✓	✓
Prickly sculpin (*Cottus asper*)	✓	✓	✓			✓	✓			✓	✓	✓	✓
Riffle sculpin (*Leptocottus armatus*)				✓									✓
Tule perch (*Hysterocarpus traski*)	✓	✓	✓									✓	✓
Hardhead (*Mylopharodon conocephalus)*													✓

TABLE 5.4.5-1 (Continued)
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name ***Scientific Name***	**1905 Synder**	**1927 Follet**	**1934 Seale**	**1938 Shapovalov**	**1953 Follett**	**1955 Follett**	**1957–1958 Follett**	**1961 Hopkirk**	**1972 Follet**	**1973 CDFG**	**1977 Scoppettone and Smith**	**1984 Leidy**	**2007 Leidy**
Native Species (cont.)													✓
Chinook salmon (*Oncorhynchus tshawytscha*)													✓
Shiner perch (*Cymatogaster aggregata*)													✓
Longjaw mudsucker (*Gillichthys mirabilis*)													✓
Staghorn sculpin (*Leptocottus armatus*)													✓
Starry flounder (*Platichthys stellatus*)													✓
Introduced													
Goldfish (*Carassius auratus*)										✓			✓
Carp (*Cyprinus carpio*)						✓	✓		✓	✓	✓	✓	✓
Golden shiner (*Notemigonus crysoleucas*)												✓	✓
White catfish (*Ictalurus catus*)						✓							✓
Black bullhead (*Ictalurus melas*)												✓	✓
Brown bullhead (*Ictalurus nebulosus*)							✓	✓					✓
Mosquito fish (*Gambusia affinis*)								✓		✓	✓	✓	✓
Inland silverside (*Menidia beryllina*)												✓	✓
Green sunfish (*Lepomis cyanellus*)								✓		✓		✓	✓
Bluegill (*Lepomis macrochirus*)					✓	✓	✓				✓		✓

TABLE 5.4.5-1 (Continued)
FISH SPECIES OBSERVED IN THE ALAMEDA CREEK WATERSHED

Common Name ***Scientific Name***	**1905 Synder**	**1927 Follet**	**1934 Seale**	**1938 Shapovalov**	**1953 Follett**	**1955 Follett**	**1957–1958 Follett**	**1961 Hopkirk**	**1972 Follet**	**1973 CDFG**	**1977 Scoppettone and Smith**	**1984 Leidy**	**2007 Leidy**
Introduced (cont.)													
Smallmouth bass (*Micropterus dolomieui*)					✓			✓				✓	✓
Largemouth bass (*Micropterus salmoides*)					✓			✓				✓	✓
Black Crappie (*Pomoxis nigromaculatus*)								✓					✓
Bigscale logperch (*Percina macrolepida*)												✓	✓
Threadfiin shad (*Dorosoma petenense*)													✓
Channel catfish *(Ictalurus punctatus)*													✓
Rainwater killfish *(Lucania parva)*													✓
Striped bass *(Morone saxatilis)*													✓
Redear sunfish *(Lepomis microlophus)*													✓
Redeye bass *(Micropterus coosae)*													✓
Yellowfin goby *(Acanthogobius flavimanus)*													✓

SOURCE: Gunther et al., 2000; Leidy, 2007.

5.4.5.2 Impacts

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to fisheries, but generally considers that implementation of the proposed program would have a significant fisheries impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species

Approach to Analysis

The effects of the WSIP on river flow and water levels in reservoirs were determined using the Hetch Hetchy/Local Simulation Model, as described in Section 5.4.1. A professional fish biologist assessed the effects of flow, reservoir level, and water temperature changes on fishery resources in the Alameda Creek watershed.

As described in Section 5.1.3, Approach to Analysis for Chapter 5 Water Supply and System Operations, and further discussed in Section 5.4.1, the existing conditions baseline used for impact analysis is based on current flow conditions in Alameda Creek that have occurred since the beginning of 2002 as a result of the DSOD restrictions on the storage capacity of Calaveras Reservoir. The proposed future condition assumes full implementation of the WSIP, including restoration of Calaveras Reservoir storage.

Impact Summary

Table 5.4.5-2 presents a summary of the impacts on aquatic habitats and fishery resources that could result from implementation of the proposed WSIP water supply and system operations.

Impact Discussion

Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir.

The storage volume within Calaveras Reservoir under proposed WSIP operations would typically be substantially greater than under current conditions. This increase in storage offers the potential

TABLE 5.4.5-2
SUMMARY OF IMPACTS –
FISHERIES IN ALAMEDA CREEK WATERSHED STREAMS AND RESERVOIRS

Impact	Significance Determination
Impact 5.4.5-1: Effects on fishery resources in Calaveras Reservoir	B
Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek	B
Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam	PSM
Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir	B
Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir	LS
Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek	LS

LS = Less than Significant impact, no mitigation required
PSM = Potentially Significant impact, can be mitigated to less than significant
B = Beneficial impact

for increased coldwater pool volume, which could benefit coldwater fish species downstream of the reservoir. A greater coldwater pool volume within the reservoir is expected to sustain colder temperatures, particularly during summer months, and improve the quality and availability of habitat downstream of the dam. In addition, increased reservoir storage would increase the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increased reservoir habitat may increase the abundance of non-native predators such as largemouth bass that prey on resident native species.

The increase in reservoir elevation under the proposed program could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a *beneficial impact* on fishery resources.

Impact 5.4.5-2: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek.

Under existing conditions, no instream flow releases have been specifically made to support fishery habitat within either Calaveras or Alameda creeks downstream of Calaveras Dam. As part of the proposed WSIP operations, instream flow releases would be made consistent with the 1997 MOU. Providing instream flow releases represents an environmental benefit to habitat quality and availability for resident rainbow trout and other fish inhabiting Calaveras Alameda creeks. As noted above, the Workgroup is identifying flow studies and analyses that may be used in the future to refine streamflow conditions within the creek. As a result of providing instream flow releases under the WSIP, the proposed program provides an environmental benefit to fishery habitat. Therefore, the proposed operations would have a less-than-significant impact, and in some cases a beneficial impact, on fishery resources in this reach of the creek.

Hydrologic modeling indicates that, in general, releases from Calaveras Dam to Calaveras Creek would be altered under WSIP operations in two ways. Under current conditions (with Calaveras Reservoir operating below design levels), peak winter flows, typically in the range of 300 to 400 cfs, that are made through controlled releases from the cone valve at the dam during January and February, are generally greater than winter flows would be under future operations with the WSIP. Under the proposed operations, instream flow releases from Calaveras Dam to Calaveras Creek would include summer releases that would not occur under current operations. Changes in instream flow releases to Calaveras Creek have the potential to support riparian vegetation along the stream channel. Instream flow releases would occur between the confluence of Calaveras and Alameda Creeks and further downstream to provide habitat for resident trout and other fishery resources. These flows are proposed to be recaptured downstream. A reduction in the magnitude of peak winter flows under the WSIP when compared to current peak flows was considered in the geomorphic analysis (Section 5.4.2) to be less than significant because high flow that could transport substantial quantities of sediment would still occur during heavy rains. The changes in flow conditions under the WSIP throughout the year, including increased average winter releases or bypasses and year-round releases or bypasses, would provide a fishery benefit through increased habitat quality and availability within Alameda Creek downstream of the confluence with Calaveras Creek compared to existing conditions.

Instream flow releases predicted to occur under WSIP operations year-round, including instream flow releases in the summer under the WSIP, would result in *beneficial impacts* on habitat quality and availability for fishery resources within Calaveras and Alameda creeks compared to existing conditions.

Impact 5.4.5-3: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam.

Alameda Creek within the reach between the diversion dam and the confluence with Calaveras Creek provides habitat for spawning and oversummering resident trout. Flows during the summer months are very low and stream habitat is fragmented. The natural low-flow summer conditions also occurred prior to construction of the diversion dam. During the low-flow period, trout and other fishes reside primarily in isolated pools. Alluvial gravels provide substrate for trout spawning, and the occurrence of multiple age classes of trout within the area demonstrates successful reproduction.

Due to restricted storage in Calaveras Reservoir, the SFPUC is generally not diverting most of the winter and spring flows to the reservoir, and those flows continue to flow down Alameda Creek past the diversion dam. As detailed in Section 5.4.1, the diversion dam has been operated infrequently during the past five years while Calaveras Reservoir storage has been reduced but is anticipated to be operated far more frequently in the future after Calaveras Reservoir storage is returned to normal operating levels. Under existing conditions, the flows in the creek support fishery habitat downstream of the diversion dam over the past five years and are expected to continue until Calaveras Reservoir storage is restored in approximately 2012.

As described in Section 5.4.1, under the WSIP, reservoir operations would be restored, and the diversion dam would be operated to divert most flows that currently flow down upper Alameda Creek (up to a maximum diversion of approximately 650 cfs) through the diversion tunnel and into the reservoir. Under the proposed program, the SFPUC would construct a bypass flow structure at the Alameda Creek Diversion Dam and would implement bypass flows consistent with the 1997 CDFG MOU when flows are available to support fishery habitat downstream of the dam. The proposed diversion of most Alameda Creek flows below 650 cfs would result in a significant change in hydrologic conditions in Alameda Creek downstream of the diversion dam when compared to existing conditions. Diversion of most or all flows during the late winter and spring months could adversely affect the ability of resident rainbow trout to spawn and for eggs to successfully incubate in this reach, although the proposed bypass flows at the diversion dam would reduce the severity of this effect. In the future, with Calaveras Reservoir storage operating at higher levels for longer periods under the WSIP, diversions to storage are expected to be reduced and the frequency and magnitude of spills from the reservoir increased.

The diversion dam is equipped with control gates but does not include a positive barrier fish screen or other protective devise that would exclude trout or other fish from being entrained through the diversion structure into Calaveras Reservoir. Trout and other fish species inhabit Alameda Creek upstream of the diversion dam and may be diverted from the creek into the reservoir under the WSIP, preventing fish passage to downstream reaches of Alameda Creek. Calaveras Reservoir provides habitat and therefore fish diverted from Alameda Creek may not be lost from the population but rather would inhabit the reservoir. Passage through the diversion dam, however, has the potential to result in increased stress, physical abrasion, and vulnerability of fish to predation mortality within the reservoir, and other potentially adverse effects. Passage of fish over the diversion dam downstream in Alameda Creek may also result in stress and potential injury to trout and other fish species. No studies have been conducted to document the frequency or significance of entrainment of fish from Alameda Creek into Calaveras Reservoir or the potential significance of future changes in the diversion structure operations under the proposed project conditions for affecting fish entrainment. Based upon results of hydrologic and operational modeling that demonstrate future conditions with the proposed program would substantially increase the frequency and magnitude of water diverted from Alameda Creek through the diversion dam, and results of studies documenting the vulnerability of fish to entrainment at unscreened water diversions, the potential impact of operating the unscreened diversion dam on fishery resources in the future is considered potentially significant.

CDFG Code Section 5980 contains requirements for water diversions greater than 250 cfs that do not affect listed salmonid species that applies to the Alameda Creek Diversion Dam. This code section requires diversion operators to provide an intake screen or other suitable method for avoiding and minimizing fish entrainment, if needed. The code section stipulates that CDFG may have partial responsibility for funding the design and construction of a fish screen. The CDFG code also provides opportunities for a water diversion operator to consult with CDFG, using information on the diversion and adjacent habitat conditions, to determine whether or not a fish screen would be required.

These impacts of diversion dam operations on trout spawning and egg incubation during the winter and spring, and on the increased vulnerability to entrainment from Alameda Creek into Calaveras Reservoir under the WSIP, are potentially significant compared to existing conditions with Alameda Creek flows bypassing the diversion tunnel to a much greater degree. Although trout and other fish passing through or over the diversion dam would be vulnerable to stress and injury, fish entrained into the diversion dam would be removed from Alameda Creek, but would be able to inhabit Calaveras Reservoir.

A reduction in peak flows in the future with Calaveras Reservoir in full operation also has the potential to affect the frequency and magnitude of channel-forming flows that support geomorphic processes within the creek; however, this effect on fishery habitat is considered less-than-significant because flows in excess of about 650 cfs would be bypassed at the diversion dam and continue downstream within Alameda Creek. As discussed in Section 5.4.2 (Geomorphology) this effect is considered to be less than significant because high flows would continue to be produced by heavy rains within the watershed, as would the sediment-clearing sluicing flows. At the same time, the diversion of higher flows up to about 650 cfs at the diversion dam could provide a fishery benefit by reducing the likelihood that eggs incubating in redds downstream of the diversion dam would be vulnerable to scour and erosion and would be expected to contribute to improved reproductive success of those fish spawning within the reach.

In the summer season, the SFPUC operations under the DSOD restrictions imposed in December 2001 and facilities on Alameda Creek allow seepage and through-flow to occur through the diversion dam and down the creek. This practice allows adequate flows to support oversummering of resident trout in Alameda Creek between the diversion dam and confluence with Calaveras Creek. The proposed program would continue this practice, therefore potential impacts on habitat during the summer would be less-than-significant.

Overall, WSIP-related impacts on fishery habitat along Alameda Creek immediately downstream of the diversion dam would be *potentially significant*, despite proposed implementation of bypass flows at the diversion dam. Implementation of Measure 5.4.5-3a: Minimum Flows for Resident Trout on Alameda Creek, which would require the SFPUC to develop operational guidelines and implement minimum instream flow requirements for Alameda Creek downstream of the diversion dam from December through April to support resident trout spawning and egg incubation, would reduce this impact to a less-than-significant level. Measure 5.4.5-3a in conjunction with the proposed bypass flows at the diversion dam may be sufficient to fully mitigate WSIP effects on resident trout in Alameda Creek, including the effects of entrainment through the diversion tunnel. If, after monitoring of this measure and adaptive management of the minimum flow requirements, the monitoring indicates that WSIP effects are not fully mitigated, then the SFPUC also will implement Measure 5.4.5-3b: Alameda Diversion Dam Diversion Restrictions or Fish Screens, to either modify seasonal diversions schedules to minimize impacts on fish or screen its diversion facilities. This measure may be refined as it would be developed in more detail and implemented as part of the Calaveras Dam (SV-2) project.

Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir.

Average storage volumes and reservoir elevations in San Antonio Reservoir under proposed operations would typically be slightly greater than under current conditions. Increased reservoir storage volume would increase the volume of habitat available for resident fish species inhabiting the reservoir, including both warmwater and coldwater fish species. The increased reservoir habitat may increase the abundance of non-native predators such as largemouth bass that prey on resident native species. The increase in storage elevations under the proposed program could also provide greater opportunities for connectivity and migration of fish between the reservoir and upstream tributary habitat. As a result of these factors, increased reservoir storage under proposed operations is considered a *beneficial impact* on fishery resources.

Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir.

Hydrologic modeling indicates a generally similar seasonal pattern in the magnitude of instream flow releases from San Antonio Reservoir to San Antonio Creek under existing conditions and with the WSIP. Proposed WSIP operations would result, on average, in slightly higher releases during the winter months (December–February) and a reduction in stream flow releases during the spring months (March–April) compared to existing conditions, while neither current nor projected future WSIP operations are anticipated to provide summer and fall base flows. The seasonal change in the timing of releases to San Antonio Creek is not expected to result in a significant impact to fishery resources. Since neither the WSIP nor current conditions provide summer and fall base flows within the creek, impacts to fishery resources are comparable under both existing and proposed operations. Therefore, impacts to fishery resources related to changes in releases from San Antonio Reservoir to San Antonio Creek would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.5-6: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek.

Releases from San Antonio Reservoir to San Antonio Creek and subsequently into Alameda Creek have historically been rare under baseline conditions and would continue to be rare with the WSIP. Releases past the dam are modeled to occur in about 20 percent of the years under the existing condition and at approximately the same frequency with the WSIP, mostly in above-normal or wet years. The WSIP would have no effect on flow in San Antonio Creek in dry, below-normal, and normal years. WSIP operations would generally reduce flows in the winter and early spring of some wet years, and occasionally in the winter of some above-normal years. Occasionally, the WSIP could result in spills to San Antonio Creek that would not occur under existing conditions. These occasional spills would be the result of the reservoir being drawn less often due to the restoration of Calaveras Reservoir storage capacity and the recapture of the 1997 MOU-flows. Since there would be only minor changes in flows within San Antonio Creek, and the contribution of San Antonio Creek flows to fishery habitat downstream within Alameda Creek between current and future WSIP operations, potential impacts on fishery resources and their habitat along Alameda Creek downstream of the confluence with San Antonio Creek would be *less than significant*, and no mitigation measures would be required.

[Additional discussion on impacts on fisheries in lower Alameda Creek was prepared in response to comments on the Draft PEIR. Please refer to Section 14.9, Master Response on Alameda Creek Fishery Issues (Vol. 7, Chapter 14).]

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5.4.6 Terrestrial Biological Resources

Operation of WSIP projects in the Alameda Creek watershed would alter the pattern of water levels in Calaveras and San Antonio Reservoirs as well as alter flows in Alameda and Calaveras Creeks. This section focuses on possible impacts on sensitive natural communities, key special-status species, and species of concern that could result from these changes. Although many terrestrial animal species may use riparian and aquatic systems intermittently for food, water, or cover, this discussion focuses on those species that depend on the riparian ecosystem for essential breeding and/or foraging habitat.

5.4.6.1 Setting

Overview

The Alameda Creek watershed provides habitat for a variety of wildlife. Grassland communities cover more than 50 percent of the watershed, and woodlands cover about 22 percent. Other habitats include freshwater marshes, where streams discharge into reservoirs, and brush, scrub, and chaparral communities in the flatter, drier, or steeper lands (SFPUC, 2007).

Ridgelands and open water make the area an attractive winter foraging and resting habitat for migrating and resident bird species, drawing birds of prey, waterfowl, and perching birds. In total, the watershed contains more than 17 types of wildlife habitat that support a range of animals, including tule elk, black-tailed deer, coyote, mountain lions, and bald eagles.

Alameda Creek Above the Alameda Creek Diversion Dam

The riparian resources along upper Alameda Creek are varied. Alameda Creek is usually a perennial stream above the diversion dam. It flows through relatively narrow alluvial valleys that support California sycamore (*Platanus racemosa*) alluvial woodland, and through narrower, more rocky areas that support bands of Central Coast arroyo willow (*Salix lasiolepis*) riparian forest and white alder (*Alnus rhombifolia*) riparian forest, bordered by coast live oak (*Quercus agrifolia*) woodland, mixed evergreen forest/oak woodland, and Diablan sage scrub.

Alameda Creek from the Diversion Dam to the Confluence with Calaveras Creek

Below the diversion dam, Alameda Creek passes through a steeply sloping, narrow bedrock channel section that supports a band of Central Coast arroyo willow riparian forest and white alder riparian forest. These forests are bordered by coast live oak woodland contained within a confined, rocky canyon. Near the confluence with Calaveras Creek, the canyon opens into a broader floodplain supporting an open California sycamore alluvial woodland and valley oak (*Quercus lobata*) savanna.

Calaveras Reservoir

Upland vegetation surrounding Calaveras Reservoir consists primarily of non-native annual grassland, coast live oak, and mixed evergreen forest and woodland, in addition to a small amount of Diablan sage scrub. An area of serpentine grassland, a sensitive natural community, is found on the east side of Calaveras Reservoir between the dam and Arroyo Hondo. A number of perennial, ephemeral, and intermittent streams enter the reservoir, and many support narrow bands of central coast arroyo willow riparian forest. The largest tributary stream, Arroyo Hondo, is a perennial stream that supports one of the largest stands of white alder riparian forest in the Alameda watershed. Small areas of freshwater marsh and seep habitat often occur at the mouth of intermittent and perennial streams where the groundwater reaches the surface and meets the reservoir level. A small, apparently relict stand of willows persists at the mouth of Calaveras Creek, well above the currently maintained reservoir levels. A large area of seasonal wetland is present in the southern, shallow edge of Calaveras Reservoir. This area may have supported perennial freshwater marsh when the reservoir was maintained at higher levels. Between the currently maintained reservoir elevation and the historically maintained maximum reservoir elevation, wave erosion has left a strip of soil with coarse surface sediments. This area is relatively bare and mainly supports weedy annual plants.

Calaveras Creek

Calaveras Creek from the dam to the confluence with Alameda Creek is situated in a deep, shaded canyon with well-developed riparian vegetation. Although mapped as sycamore alluvial woodland (SFPUC, 2001), riparian vegetation along the creek also includes arroyo willow riparian forest and other species such as Fremont cottonwood (*Populus fremontii*) and valley oak.

Alameda Creek from Calaveras Creek to the Confluence with San Antonio Creek

From the confluence with Calaveras Creek to the confluence with San Antonio Creek, Alameda Creek begins as a broader watercourse with widely arcing bends and a continuous mixed-species riparian canopy composed of arroyo willow riparian forest and white alder riparian forest, with occasional Fremont cottonwoods (*Populus fremontii*), valley oaks, box elder (*Acer negundo* var. *californica*), and sycamores. Some large areas of valley oak savanna are associated with alluvial terraces along this section of the creek (SFPUC, 2001). During the summer months, surface water is present in pools, especially from the confluence with Calaveras Creek to the Sunol Valley WTP. From the Sunol Valley WTP to San Antonio Creek, Alameda Creek is situated in a quarter-mile-wide valley with a broad, cobbly floodplain that support sycamore alluvial woodland on the coarser soils, valley oak savanna on the finer soils, and narrow bands of arroyo willow scrub near the channel. Alameda Creek flows in this reach during the winter and spring rainy season, but dries up completely during the summer and fall due to high infiltration rates, especially in the lower portion of the reach. Portions of the former floodplain in the lower section of this reach have been developed as nurseries and aggregate quarries.

San Antonio Reservoir

Upland vegetation surrounding San Antonio Reservoir is primarily non-native annual grassland. North-facing slopes on the south side of San Antonio Reservoir support mixed evergreen and coast live oak woodland. Where minor tributaries enter San Antonio Reservoir, narrow bands of coast live oak riparian forest follow the watercourse and streambanks. On larger tributaries such as Indian Creek and San Antonio Creek, well-developed stands of sycamore alluvial woodland, valley oak savanna, and possibly white alder riparian forest line the channels. Some areas of emergent vegetation are found at the mouths of the larger creeks. As is typical for reservoirs operated for water storage, a strip of unvegetated, wave-terraced soil is exposed when water levels fall below the usual maximum.

San Antonio Creek

San Antonio Creek below the dam supports native vegetation for a little over a mile (to Calaveras Road) before entering the highly disturbed gravel extraction area. The creek supports a diverse assemblage of central coast arroyo willow scrub in the upper section nearest the dam, and sycamore alluvial woodland in the section farther downstream. The creek flows little if at all, so the riparian vegetation is fed primarily by seepage. As with most sycamore alluvial woodland, the channel-forming processes needed for stand regeneration are no longer present, and all of the trees are large and mature with no evident recruitment.

Alameda Creek Below San Antonio Creek

Below the confluence with San Antonio Creek, Alameda Creek first passes through aggregate quarries. No vegetation and little flow occur in this area. Below the gravel quarries, Alameda Creek passes the Sunol Water Temple. In this area, the creek supports arroyo willow riparian forest, coast live oak riparian forest, and sycamore alluvial woodland before entering Niles Canyon—a broad, rocky canyon with an intermittent riparian canopy of mixed willows, cottonwoods, sycamores, and valley oaks. This section of Alameda Creek, below the confluence with Arroyo de la Laguna, flows year-round. The majority of dry-season flow below Sunol is derived from releases of South Bay Aqueduct water destined for groundwater recharge at the mouth of Niles Canyon.

Natural Communities, including Sensitive Natural Communities

Section 4.6, Biological Resources, presents a general discussion of wildlife habitats and sensitive natural communities. Figure 4.6-2b shows the distribution of habitat types in the Alameda watershed. Section 4.6 also provides additional detail specific to the Alameda watershed, including information on common or widespread natural communities. Roughly half of the Alameda watershed supports grassland, primarily non-native grassland. Diablan sage scrub is found on steep, rocky, exposed uplands with little soil development. Sheltered or drier sites with more soil development support forest and woodlands, while riparian forest and scrub are found along the major watercourses. The *Alameda Watershed Management Plan Environmental Impact Report* (San Francisco Planning Department, 2000) identified 18 natural community types within the watershed, six of which the California Natural Diversity Database (CNDDB) lists as sensitive (CDFG, 2006). Ten natural communities are found within the WSIP program area, of which six are considered sensitive. **Table 5.4.6-1** presents the name, status, and occurrence of natural communities within the program area in the Alameda watershed. These communities are briefly described in the paragraphs that follow.

- **Grasslands.** Serpentine grassland is specifically associated with soils derived from serpentine rock. These grasslands are characterized by a relatively high proportion of native species, many perennial grasses, and relatively low productivity. Typical perennial grasses

TABLE 5.4.6-1
POTENTIAL FOR OCCURRENCE OF NATURAL COMMUNITIES IN THE ALAMEDA WATERSHED WSIP PROGRAM AREA

Natural Community[a]	Alameda Creek above diversion dam	Calaveras Reservoir	Alameda Creek from diversion dam to confluence with Calaveras Creek	Calaveras Creek	Alameda Creek below confluence with Calaveras Creek	San Antonio Reservoir	San Antonio Creek	Alameda Creek below San Antonio Creek
Grasslands								
Serpentine grassland*		X						
Non-native grassland		X				X		
Chaparral and Scrub								
Diablan sage scrub	X	X						
Forest and Woodland								
Mixed evergreen forest/coast live oak woodland	X	X	X			X		
Valley oak woodland and savanna	X		X		X	X		
Central coast arroyo willow riparian forest*	X	X	X	X	X	X	X	X
Sycamore alluvial woodland*	X		X	X	X	X	X	X
White alder riparian forest*	X	X	X		X	X		
Central coast live oak riparian forest*						X		X
Marsh								
Coastal and valley freshwater marsh		X				X		

[a] An asterisk (*) indicates a sensitive natural community, as identified in the California Natural Diversity Database (CDFG, 2006).

include purple needlegrass (*Nassella pulchra*), pine bluegrass (*Poa secunda*), fescue (*Festuca* spp.), and junegrass (*Koeleria cristata*). Within the program area, serpentine grassland is found on the eastern shoreline of Calaveras Reservoir and on the ridge south of the reservoir west of Calaveras Creek. Non-native grassland is dominated by a variety of non-native annual grasses such as brome (*Bromus* spp.), oats (*Avena* spp.), and wild barley (*Hordeum* spp.) as well as herbs such as filaree (*Erodium* spp.), with less abundant native annual and perennial grasses and herbs.

Non-native grassland is the most common natural community on the watershed, bordering most of San Antonio Reservoir and much of the southern half of Calaveras Reservoir. It also adjoins riparian habitats along the creeks. Non-native grassland is dominated by a variety of non-native annual grasses and herbs, with less abundant native annual and perennial grasses and herbs. Small areas of valley needlegrass grassland may also be present in rocky areas, but were too small to map (Jones and Stokes, 2003).

- **Diablan sage scrub (or north coast scrub).** This shrub-dominated community is typically found on steep, rocky, exposed slopes. In the watershed, this community is dominated by coyote brush (*Baccharis pilularis*), poison-oak (*Toxicodendron diversilobum*), bush monkeyflower (*Mimulus aurantiacus*), and California sage (*Artemisia californica*) in various proportions. Diablan sage scrub is found along the Arroyo Hondo arm on the eastern side of Calaveras Reservoir, and in small areas on the western side of the reservoir.

- **Forests and woodlands.** Mixed evergreen forest and coast live oak woodland are the most abundant forest communities on the watershed. These communities are typically found in less-exposed areas that have deeper soils than the scrub and grassland communities. Mixed evergreen forest is dominated by coast live oak, California bay (*Umbellularia californica*), and sometimes madrone (*Arbutus menziesii*), Douglas-fir (*Pseudotsuga menziesii*), and big-leaf maple (*Acer macrophyllum*). It tends to form a closed canopy with a shrubby or grassy understory. Coast live oak woodland is dominated by a single species, coast live oak. Coast live oak can form a nearly closed canopy forest in favorable sites with deep soils and ample soil moisture, or an open woodland with a grassy understory in drier areas. These communities are found in nearly all of the sheltered canyons and north-facing slopes in the watershed, including extensive areas along the shore of Calaveras Reservoir and smaller areas on the south side of San Antonio Reservoir.

  Valley oak woodland is limited primarily to the deep alluvial soils found along the floodplains of the major drainages such as Alameda Creek. It consists of an open canopy of a single tree species, valley oak, with an understory resembling non-native grassland.

- **Riparian forests.** Central coast arroyo willow riparian forest occurs in moist canyons, usually with perennial stream flow or seepage. It is a dense, broadleaved, winter-deciduous forest dominated by arroyo willow, which grows as a large, tree-like shrub. This is the most common riparian type on smaller streams in the Central Coast of California, and it is found in sections of Alameda Creek, Arroyo Hondo, and San Antonio Creek as well as various unnamed tributaries. It requires the least amount of groundwater and surface flow of any of the riparian communities discussed in this section.

  Sycamore alluvial woodland is an open woodland dominated by California sycamore. It is found along streams with very high peak flows and broad floodplains composed mainly of cobbles and other coarse material. Sycamore alluvial woodland in the Alameda watershed is best developed on the broad floodplain of Alameda Creek in the Sunol Valley, although examples also exist along San Antonio Creek.

  White alder riparian forest is a medium-tall, broadleaved, deciduous streamside forest; it is dominated by white alder and has a shrubby, deciduous understory. It is found along flowing perennial streams with coarse sediments such as Alameda Creek and Arroyo Hondo.

  Central coast live oak riparian forest is an evergreen riparian forest dominated by coast live oak. This community is present along the lower sections of Alameda Creek near the Sunol Water Temple and in Niles Canyon.

- **Marshes.** Coastal and valley freshwater marsh is a wetland community dominated by usually dense stands of perennial, emergent grass and grass-like plants up to 15 feet tall. Coastal and valley freshwater marsh is found in areas that are permanently flooded by fresh water. Small examples of this community are found around the perimeter of the reservoirs, where seepage from streams allows for this community to develop.

Seasonal wetland is not recognized by Holland (1986) as a natural community because it typically develops where managed hydrology creates an environment that is flooded or saturated for extended periods and then dries, but the inundation occurs for a shorter time, in a different season, or more irregularly than is required for development of freshwater marsh. The species found in seasonal wetland are variable, but non-native annuals in the grass, sunflower, and buckwheat families often dominate this vegetation type.

Key Special-Status Species and Other Species of Concern

Appendix D presents a list of key special-status plant and animal species and other species of concern considered in the preparation of the PEIR for the *Alameda Watershed Management Plan* (San Francisco Planning Department, 2000). Although very inclusive, the plan concludes that most of the species are unlikely to occur in the watershed because of distributional range or habitat requirements. Section 4.6, Figure 4.6-2b shows the location of federally designated critical habitats in the Alameda watershed. The following key special-status plant and animal species and species of concern (see **Tables 5.4.6-2** and **5.4.6-3**) could be affected by WSIP operations due to their potential to occur in the watershed and their proximity, association, or dependence on reservoirs or streams:

- **Serpentine-associated plants.** Most beautiful jewel-flower (*Streptanthus albidus* ssp. *peramoenus*; California Native Plant Society [CNPS] List 1B) was observed by EDAW (in prep.) during 2006 botanical surveys for the Calaveras Dam project (SV-2). It was located in the serpentine grassland east of Calaveras Reservoir, but was not within the maximum water surface elevation. Suitable serpentine habitat is present in the Alameda watershed for the following species, but none were found during detailed botanical surveys for the Calaveras Dam project (May, 2006): Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*, CNPS List 1B), Presidio clarkia (*Clarkia franciscana*, federal endangered, California endangered, CNPS List 1B), Fragrant fritillary (*Fritillaria liliacea*, CNPS List 1B), Chaparral harebell (*Campanula exigua*, CNPS List 1B), Mt. Hamilton thistle (*Cirsium fontinale* var. *camplyon*, CNPS List 1B), and Santa Clara Valley dudleya (*Dudleya setchellii*, federal endangered, CNPS List 1B). No suitable habitat was found within the maximum elevation of Calaveras Reservoir or within the riparian habitats potentially affected by WSIP operations.

- **Grassland, scrub, and woodland plants.** Diablo helianthella (*Helianthella castanea*, CNPS List 1B) grows in openings in forest, chaparral, coastal scrub, riparian woodland, and sheltered grasslands. EDAW mapped four occurrences of this species in the Calaveras Reservoir (SV-2) construction area (May, 2006), but not within the area that would be affected by reservoir operations. Suitable habitat is present in the Alameda watershed for the following species, but none were found during detailed botanical surveys for the Calaveras Dam project (May, 2006), and no suitable habitat was present within the maximum elevation of Calaveras Reservoir or within the riparian habitats potentially affected by WSIP operations: bent-flowered fiddleneck (*Amsinckia lunaris*, CNPS List 1B), which occurs in woodland and grassland; big-scale balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*, CNPS List 1B), which grows in chaparral, cismontane woodland, and grasslands, and sometimes in serpentine soils; robust spineflower (*Chorizanthe robusta* var. *robusta*, federal endangered, CNPS List 1B), which is found on sandy or gravelly substrates in woodland openings and coastal scrub; Mt. Hamilton coreopsis (*Coreopsis hamiltonii*, CNPS List 1B), which grows in rocky sites in woodlands (although the Alameda watershed is generally lower in elevation than the species' known range); Hospital Canyon larkspur (*Delphinium californicum* ssp. *interius*, CNPS List 1B), which

TABLE 5.4.6-2
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS PLANTS AND PLANT SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

			WSIP Program Area[a]			
Common Name / ***Scientific Name***	**USFWS/CDFG/ CNPS Status**[b]	**Habitat**	**Calaveras and Alameda Creek below Diversion**	**Calaveras Reservoir**	**San Antonio Creek**	**San Antonio Reservoir**
Bent-flowered fiddleneck *Amsinckia lunaris*	–/–/1B	Woodland and valley grassland		Potential nearby		Potential nearby
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	–/–/1B	Chaparral, woodland, and grassland, sometimes in serpentinite		Potential nearby		Potential nearby
Chaparral harebell *Campanula exigua*	–/–/1B	Chaparral or rocky (usually serpentinite) areas		Potential nearby		
Robust spineflower *Chorizanthe robusta* var. *robusta*	FE–/1B*	Sandy or gravelly soil in woodland openings or scrub		Potential nearby		
Mt. Hamilton thistle *Cirsium fontinale* var. *campylon*	–/–/1B	Serpentine seeps		Potential nearby		
Presidio clarkia *Clarkia franciscana*	FE/CE/1B*	Serpentine grasslands		Potential nearby		
Mt. Hamilton coreopsis *Coreopsis hamiltonii*	–/–/1B	Rocky sites in woodland		Potential nearby		
Hospital Canyon larkspur *Delphinium californicum ssp. interius*	–/–/1B	Openings in chaparral habitat, woodland		Potential nearby		Potential nearby
Santa Clara Valley dudleya *Dudleya setchellii*	FE/–/1B*	Rocky serpentinite areas in woodland and grassland		Potential nearby		
Fragrant fritillary *Fritillaria liliacea*	–/–/1B	Clay soils, often on serpentine soils		Potential nearby		
Diablo helianthella *Helianthella castanea*	–/–/1B	Openings in woodland, chaparral, shady grassland		Potential nearby		Potential nearby
Hall's bush mallow *Malacothamnus hallii*	–/–/1B	Chaparral and coastal scrub		Potential nearby		Potential nearby
Maple-leaved checkerbloom *Sidalcea malvaeflora*	–/–/1B	Upland forest, coastal scrub, often in disturbed areas		Potential nearby		Potential nearby
Most beautiful jewel-flower *Streptanthus albidus var. peramoenus*	–/–/1B	Serpentine soils in chaparral, woodland, and grassland		Present nearby		

[a] The WSIP program area is the extent that could be affected by program operations, such as below maximum reservoir elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS), state (CDFG), and CNPS protection status codes are as follows:

FC:	Federal candidate for listing	CE:	California endangered
FE:	Federal endangered	CT:	California threatened
FT:	Federal listed as threatened	1B:	CNPS List 1B, rare and endangered
FD:	Federal delisted	–	Indicates no federal or state protection

* Indicates key special-status plants, defined here to mean federal- or state-listed as endangered or threatened.

SOURCES: CDFG, 2006, 2007; USFWS, 2007; May, 2006.

TABLE 5.4.6-3
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

			WSIP Program Area[a]			
Common Name *Scientific Name*	**USFWS/CDFG Status[b]**	**Habitat**	**Calaveras and Alameda Creek below Diversion**	**Calaveras Reservoir**	**San Antonio Creek**	**San Antonio Reservoir**
Invertebrates						
Bay checkerspot butterfly *Euphyhydras editha bayensis*	FT/–*	Serpentine bunchgrass and valley needlegrass grassland		Poor-quality habitat nearby		
Callippe silverspot butterfly *Speyeria callippe callippe*	FE/–*	Grasslands with *Viola pedunculata* and nearby adult nectar sources		Population with characteristics “near to” those of species present		
Reptiles and Amphibians						
California tiger salamander *Ambystoma californiense*	FT/CSC*	Ponds for breeding and grassland burrows for retreat	Present	Present	Potential	Potential
California red-legged frog *Rana aurora draytonii*	FT/CSC*	Slow-moving streams and ponds	Present	Present	Potential	Potential
Foothill yellow-legged frog *Rana boylii*	–/CSC*	Shallow, moving water with sunny banks	Present	Present, Arroyo Hondo		
Western pond turtle *Clemmys marmorata*	–/CSC	Permanent water, streams, ponds	Present	Present	Potential	Potential
Alameda whipsnake *Masticophis lateralis euryxanthus*	FT/CT*	Coastal scrub and chaparral	Nearby	Nearby	Nearby	Nearby
Birds						
Osprey *Pandion haliaetus* (nesting)	–/CSC	Open water, large trees and snags		Potential		Potential
White-tailed kite *Elanus leucurus* (nesting)	FP/–	Forages in open meadows, grasslands; nests in moderately tall trees				
Bald eagle *Haliaeetus leucocephalus* (nesting and wintering)	FD/CE, FP*	Forages in large bodies of water or rivers with adjacent snags or large, tall trees		Present		Potential
Northern harrier *Circus cyaneus* (nesting)	–/CSC	Forages and nests in marshes, moist grasslands, and meadows		Potential		Potential

TABLE 5.4.6-3 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA

			WSIP Program Area[a]			
Common Name ***Scientific Name***	**USFWS/CDFG Status[b]**	**Habitat**	**Calaveras and Alameda Creek below Diversion**	**Calaveras Reservoir**	**San Antonio Creek**	**San Antonio Reservoir**
Birds (cont.)						
Sharp-shinned hawk *Accipiter striatus* (nesting)	–/CSC	Forages in woodlands; nests in coniferous or mixed forests	Potential	Potential	Potential	Potential
Cooper's hawk *Accipiter cooperii* (nesting)	–/CSC	Forages in many habitats; nests in forest and woodland	Potential	Potential	Potential	Potential
Ferruginous hawk *Buteo regalis* (wintering)	–/CSC	Forages in open grasslands	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Golden eagle *Aquila chrysaetos* (nesting and wintering)	FP/CSC, FP	Forages in open grassland; nests in large trees, on cliffs or embankments	Potential nearby	Potential nearby	Potential nearby	Potential nearby
American peregrine falcon *Falco peregrinus anatum* (nesting)	FD/CE, FP*	Forages for birds in open areas; nests on cliffs		Potential		Potential
Prairie falcon *Falco mexicanus* (nesting)	–/CSC	Forages in open areas; nests on cliffs or ledges	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Burrowing owl *Athene cunicularia* (burrowing sites)	–/CSC*	Open grasslands with available burrows	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Long-eared owl *Asio otus* (nesting)	–/CSC	Dense riparian and oak woodlands	Potential	Potential	Potential	Potential
Loggerhead shrike *Lanius ludovicianus* (nesting)	–/CSC	Grasslands and open woodlands with scattered shrubs	Potential nearby	Potential nearby	Potential nearby	Potential nearby
California horned lark *Eremophila alpestris actia* (nesting)	–/CSC	Grasslands, especially sparsely vegetated or barren areas	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Bell's sage sparrow *Amphispiza belli belli* (nesting)	–/CSC	Semi-open dry chaparral and coastal sage scrub	Potential nearby	Potential nearby	Potential nearby	Potential nearby

**TABLE 5.4.6-3 (Continued)
POTENTIAL FOR OCCURRENCE OF KEY SPECIAL-STATUS ANIMALS AND ANIMAL SPECIES OF CONCERN IN THE WSIP ALAMEDA WATERSHED PROGRAM AREA**

			WSIP Program Area[a]			
Common Name ***Scientific Name***	**USFWS/CDFG Status[b]**	**Habitat**	**Calaveras and Alameda Creek below Diversion**	**Calaveras Reservoir**	**San Antonio Creek**	**San Antonio Reservoir**
Birds (cont.)						
Tricolored blackbird *Agelaius tricolor* (nesting)	–/CSC	Colonial nester in dense freshwater marsh or riparian vegetation with access to insect prey		Potential		Potential
Mammals						
Pallid bat *Antrozous pallidus*	–/CSC	Roosts in trees; forages over grassland	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Pacific western big-eared bat *Corynorhinus (=Plecotus) townsendii*	–/CSC	Roosts in caves and buildings; forages in open country	Potential nearby	Potential nearby	Potential nearby	Potential nearby
Western mastiff bat *Eumops perotis californicus*	–/CSC	Requires cliff faces with high vertical drop; may roost in trees	Potential nearby	Potential nearby	Potential nearby	Potential nearby
American badger *Taxidea taxus*	–/CSC	Drier open grassland, shrub, and forest habitats with friable soils	Potential nearby	Potential nearby	Potential nearby	Potential nearby

[a] The WSIP program area is the extent that could be affected by program operations, such as below maximum reservoir elevations, or within riparian areas where changes in flows could affect habitat.
[b] Federal (USFWS) and state (CDFG) protection status codes are as follows:
FC: Federal candidate for listing
FE: Federal endangered
FT: Federal threatened
FD: Federal delisted
CE: California endangered
CT: California threatened
CSC: California species of special concern
FP: California fully protected
– Indicates no federal or state protection

* Indicates key special-status animals, defined here to mean federal- or state-listed as endangered or threatened.

SOURCES: San Francisco Planning Department, 2000; Leeman, 2006; Jennings and Hayes, 1994; CDFG, 2006.

grows in openings in chaparral habitat and cismontane woodland; Hall's bush mallow (*Malacothamnus hallii*, CNPS List 1B), which grows in chaparral and coastal scrub; and maple-leaved checkerbloom (*Sidalcea malvaeflora*, CNPS List 1B), which grows in upland forest and coastal scrub, often in disturbed sites. All of these species have a low to moderate potential to occur at the perimeter of San Antonio Reservoir, but no suitable habitat is present within the maximum water surface elevation of the reservoir.

- **Perennial grassland invertebrates.** Callippe silverspot butterfly (*Speyeria callippe callippe*, federal endangered) requires grasslands supporting the larval foodplant Johnny-jump-up (*Viola pedunculata*) and adult nectar sources such as California buckeye (*Aesculus californica*) nearby. Entomological Consulting Services (2004) found a population of Callippe silverspots on the watershed that is intermediate in appearance between the listed subspecies and a related, non-endangered subspecies. The author concluded that these populations should be protected, but should be considered "near to" the Callippe silverspot. Bay checkerspot butterfly (*Euphydryas editha editha*, federal endangered) occurs on serpentine grasslands supporting native plantain (*Plantago erecta*) and annual owl's-clover (*Castilleja* spp.). Entomological Consulting Services (2005) carried out intensive surveys for Bay checkerspot butterfly in 2004 and 2005. The species was not found, and the author concluded that habitat quality on the watershed for this species was poor.

- **Reptiles and amphibians.** California tiger salamander (*Ambystoma californiense*, federal threatened, California species of special concern) and California red-legged frog (*Rana aurora draytonii*, federal threatened, California species of special concern) are known to occur in several locations in the Alameda watershed. California tiger salamander breeds in vernal pools and permanent ponds or lakes and estivate in burrows in adjacent uplands. The species is known to breed around the perimeter of Calaveras Reservoir and in Calaveras Creek below the dam (Leeman, 2006). Suitable habitat is also present in stock ponds and possibly San Antonio Reservoir and Alameda and San Antonio Creeks. California red-legged frog breeds in still or slow-moving water such as the edges of reservoirs, often with emergent vegetation. This species has been documented in Alameda Creek below Calaveras Creek and in stock ponds in several locations in the Alameda watershed. Suitable habitat is also present at San Antonio Creek and San Antonio Reservoir.

  Foothill yellow-legged frog (*Rana boylii*, California species of special concern) breeds in shallow, flowing streams with cobbles, sunny banks, and some riffles. The species is known to breed in Alameda Creek between the diversion tunnel and the gravel mines at the lower end of the Sunol Valley, as well in Arroyo Hondo (Leeman, 2006). The Alameda watershed may support one of the largest areas of suitable habitat for this species in the Bay Area.

  Western pond turtle (*Actinemys = Clemmys marmorata*, California species of special concern) breeds in Alameda Creek below the confluence with Calaveras Creek where water is present year-round, in Arroyo Hondo, in side channels of Alameda Creek below the Sunol Water Temple, and in at least one other pond within the watershed.

  Alameda whipsnake (*Masticophis lateralis euryxanthus*, federal threatened, California threatened) is known to be present in many localities within the Alameda watershed. It inhabits coastal scrub and nearby grassland and woodland habitats. Suitable habitat is present on the perimeter of Calaveras and San Antonio Reservoirs, but not within the maximum water surface elevation.

- **Riparian-associated birds.** Several bird species of concern are closely associated with the riparian and wetland habitats in the Alameda watershed. Riparian trees have a moderate potential to support nesting and foraging Cooper's hawk (*Accipiter cooperi*, California species of special concern) and sharp-shinned hawk (*A. striatus*, California species of special concern). Long-eared owl (*Asio otus*, California species of special concern) nests in dense riparian and oak woodlands. Suitable habitat is present throughout the program area in the Alameda watershed.

- **Marsh- and lake-dependent birds.** Tricolored blackbird (*Agelaius tricolor*, California species of special concern) nests in freshwater emergent vegetation. Although no colonies are known to occur in the Alameda watershed, suitable habitat may be present on the margins of Calaveras and San Antonio Reservoirs. Northern harrier (*Circus cyaneus*, California species of special concern) nests and forages in wet meadows and pastures; a limited amount of habitat is present within the watershed, primarily in the vicinity of San Antonio and Calaveras Reservoirs. Bald eagle (*Haliaeetus leucocephalus*, federal endangered – delisted and California endangered) and osprey (*Pandion haliaetus*, California species of special concern) forage in lakes and reservoirs and nest in large trees nearby. A pair of nesting bald eagles was recently reported in the Alameda watershed, and the species could breed or winter near San Antonio and Calaveras Reservoirs. Peregrine falcon (*Falco peregrinus anatum*, federal delisted, California endangered) nests in cliffs and outcrops and forages near wetlands and open water. Loggerhead shrike (*Lanius ludovicianus*, California species of special concern) nests in riparian and other woodlands and forages over open country. It may be present throughout the Alameda watershed in suitable habitat.

- **Upland birds.** Burrowing owl (*Speotyto = Athene cunicularia*, California species of special concern) lives in mammal burrows in open, sloping grasslands. The range of this species includes the Alameda watershed. Ferruginous hawk (*Buteo regalis*, California species of special concern) winters in the Bay Area, where it forages in open grasslands and agricultural fields. Suitable habitat may be present in the extensive watershed grasslands, including those near the reservoirs. Golden eagle (*Aquila chrysaetos*, California species of special concern) forages in open grasslands and agricultural areas, and nests in large trees. It has been known to breed in the Alameda watershed and may forage near San Antonio and Calaveras Reservoirs. Foraging habitat may be present throughout the Alameda watershed. Prairie falcon (*Falco mexicanus*, California species of special concern) nests in cliffs or ledges and forages over grasslands. Suitable habitat is present within the Alameda watershed, including near San Antonio and Calaveras Reservoirs and within the Sunol Valley. California horned lark (*Eremophilus alpestris actia*, California species of special concern) nests in sparse grasslands and barren areas. Suitable habitat may be present in the grasslands near the reservoirs and in the Sunol Valley. Bell's sage sparrow (*Amphispiza belli belli*, California species of special concern) nests in chaparral and coastal scrub. Suitable habitat may be present near the reservoirs.

- **Mammal species.** Pallid bat (*Antrozous pallidus*, California species of special concern) roosts in trees and forages over open grassland and could occur throughout the watershed. Pacific western (Townsend's) big-eared bat (*Corynorhinus townsendii*) roosts in caves and buildings and forages in open country. Suitable habitat is present near both Calaveras and San Andreas Reservoirs and the open areas of the Sunol Valley. Western mastiff bat (*Eumops perotis californicus*, California species of special concern) roosts on cliffs and forages in open country. Its primary foraging area in the vicinity of the program area would be near Calaveras and San Antonio Reservoirs.

5.4.6.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to terrestrial biological resources, but generally considers that implementation of the proposed program would have a significant biological impact if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or substantially reduce the number or restrict the range of an endangered, rare or threatened species
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

Approach to Analysis

The assessment of WSIP operational impacts on terrestrial biological resources focuses primarily on the extent to which proposed operations would change the existing habitat near reservoirs and creeks. Operational changes consist of increased diversions from Alameda Creek during late fall, winter, and early spring; increased releases to Calaveras Creek to maintain minimum flows; and changes in the elevation, annual range, and seasonal timing of reservoir levels. An overview of the general types of effects of stream diversions on riparian ecological resources is provided in Section 5.3.7. An assessment of the changes in hydrology in the Alameda Creek watershed under the WSIP is presented in Section 5.4.1.

This section discusses impacts on riparian and wetland habitats, key special-status species, other species of concern, and common habitats and species. The discussion of riparian and wetland habitats addresses the second and third significance criteria listed above. “Key special-status species” include species that are formally listed as endangered or threatened under the state or federal endangered species acts, as well as a few other species (such as burrowing owl and foothill yellow-legged frog) that are afforded some degree of legal protection and have a high risk of local population decline or extirpation. The key special-status species discussion addresses the first significance criterion. “Other species of concern” and “common habitats and species” are more general categories relevant to the fourth and fifth significance criteria.

As discussed in Section 5.1, the existing conditions baseline setting used in the PEIR for impact analysis reflects the current flow conditions in Alameda Creek since DSOD imposed storage restrictions on Calaveras Reservoir in December 2001, which substantially reduced SFPUC’s typical diversions from the creek to the reservoir. Section 5.4.1, above, further describes current flow conditions in Alameda Creek and how they changed in 2002 from the previous 70 years of SFPUC diversion. Riparian stand structure, especially when dominated by long-lived trees, responds slowly to changes in stream flow. Riparian structure today is the result of physical responses that have prevailed over the lifetime of the plants. In general, plants are most vulnerable during germination and establishment; if conditions become less favorable afterward, individuals may continue to persist but without successful recruitment. Therefore, the condition, distribution, and abundance of short-lived or young plants reflect existing stream flow conditions; those of moderately aged trees and shrubs reflect a combination of both older (pre-2002) and existing flow conditions; and those of old trees, such as mature California sycamores and valley oaks, reflect a combination of pre-Calaveras Reservoir, pre-2002 (prior to DSOD restrictions on Calaveras Reservoir storage), and existing operations. The impact analysis uses the existing conditions (2005) baseline but the history of flows in Alameda Creek is discussed in the impact analysis where appropriate because of the role of historic flows in shaping existing resources such as the riparian vegetation.

Impact Summary

Table 5.4.6-4 presents a summary of the impacts on terrestrial biological resources in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

Impact Discussion

Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir.

Sensitive Habitats

Impact of Higher Storage Levels. Calaveras Reservoir is surrounded by wetland and upland habitats that formed since December 2001, when the reservoir storage levels were lowered. These habitats, in turn, are surrounded by well-established riparian, grassland, woodland, and scrub habitats growing above the high-water elevation. Under the WSIP, restoring the original storage capacity of Calaveras Reservoir would result in the inundation and permanent loss of the seasonal wetlands, seeps, perennial freshwater marsh, and riparian habitat that have formed since 2002. Prior to 2002, these areas were regularly inundated, sometimes for several months at a time.

TABLE 5.4.6-4
SUMMARY OF IMPACTS –
TERRESTRIAL BIOLOGICAL RESOURCES IN THE ALAMEDA CREEK WATERSHED

Impacts	Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species
Impact 5.4.6-1: Effects on riparian habitat and related biological resources in Calaveras Reservoir	PSM	PSM	LS	LS
Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek	LS	PSM	LS	N/A
Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek	LS	PSM	LS	LS
Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek	LS	PSM	LS	LS
Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir	LS	LS	LS	LS
Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek	LS	LS	LS	N/A
Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek	LS	LS	LS	N/A
Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans	LS			

LS = Less than Significant impact, no mitigation required
PSM= Potentially Significant impact, can be mitigated to less than significant
N/A = Not Applicable

The Calaveras Dam project (SV-2) would not raise the maximum reservoir levels any higher than historical levels. Therefore, no sensitive upland habitats or riparian habitats higher than the spillway elevation would be inundated. Areas of well-developed riparian forest along Calaveras Creek and Arroyo Hondo above Calaveras Reservoir would therefore not be affected by the proposed WSIP operations. However, because seasonal wetlands, seeps, and other wetland features below the current maximum reservoir elevation would be inundated, the impact on sensitive habitats of restoring reservoir levels at Calaveras Reservoir is *potentially significant*. Although the impact of fluctuating reservoir elevation is discussed for other reservoirs, this impact is not applicable to Calaveras Reservoir because wetlands within the existing operational range would be inundated and lost.

Impacts of Periodic Drawdowns. Under the WSIP, the reservoir would be lowered by up to 20 feet for an extended period during systemwide maintenance (every five years), which could affect riparian and freshwater marsh habitats that depend on sustained moist soil or standing water. However, the existing riparian and wetland habitats above the spillway elevation have tolerated an extended drawdown since December 2001 and can be expected to tolerate periodic drawdowns of shorter duration, such as those proposed under the WSIP. Some studies have suggested that occasional, appropriately timed dewatering can enhance wetland diversity by providing unusual opportunities for germination and establishment (e.g., Schneider, 1994); however, lowering the reservoir level would not necessarily benefit freshwater marsh or riparian vegetation. These potentially beneficial and adverse impacts are relatively minor; the impact of reservoir operations would be less than significant.

Key Special-Status Species

Key special-status species potentially affected by Calaveras Reservoir operations under the WSIP include California red-legged frog, foothill yellow-legged frog, California tiger salamander, and bald eagle. Suitable upland habitat is not present within the operational area of Calaveras Reservoir for other key special-status species discussed in this section, such as Callippe silverspot butterfly, Alameda whipsnake, burrowing owl, and peregrine falcon.

In a study of water level fluctuations for a similar reservoir project in Washington State (but applicable here), Devine Tarbell & Associates (2006) examined the effect of modest daily fluctuations on the two most vulnerable impact receptors: amphibians and waterbirds. First, the study authors note that littoral wetlands (those on or near the shore) are well suited to handling changes in soil moisture and water content that are of short duration. The study evaluated seven species of common amphibians and made several observations. Amphibian eggs are generally laid in shallow water or are attached to vegetation high in the water column. As such, water level fluctuations of even a few inches can expose developing eggs to desiccation, freezing, or increased predation. However, the authors conclude that minor fluctuations are likely less important than other factors governing habitat suitability in habitats connected to the reservoir, such as the presence of predatory fish, wave action, scant vegetative cover, and water temperature. Put another way, lakeside species are adapted to varying water levels, which occur in natural water bodies as well as managed ones.

Restoring the operational capacity of Calaveras Reservoir under the WSIP would result in the inundation and loss of poor-quality upland habitat for California tiger salamander and California red-legged frog. Habitat below the pre-2002 maximum reservoir level was not considered part of the designated critical habitat for California tiger salamander; no critical habitat for California red-legged frog is present in this area. Due to the low quality of upland habitat that would be inundated by restoring Calaveras Reservoir to its former levels, this impact would be less than significant.

Higher reservoir levels under the WSIP would reduce the duration of flowing water in Arroyo Hondo and Calaveras Creek. Arroyo Hondo is a perennial stream and has high-quality habitat for foothill yellow-legged frogs in the well-developed riparian sections above the maximum spillway elevation. Arroyo Hondo has about 10,000 linear feet of stream channel habitat between the DSOD-mandated maximum reservoir elevation and the spillway elevation. Actual reservoir elevations have varied considerably since December 2001, and have sometimes been held 20 to 30 feet higher than the DSOD-mandated level, occasionally reducing this habitat to about a mile. Although Arroyo Hondo is a perennial stream above the former maximum reservoir elevation, the CDFG observed in August 2004 that the section below this elevation was dry (CDFG, 2005), indicating it was not perennial in this section (CDFG, 2005). Yellow-legged frogs have been observed in this section of Arroyo Hondo (between the DSOD maximum and the pre-2002 maximum) since 2002. Although the habitat is of limited quality and apparently intermittent as well, it is occupied by foothill yellow-legged frogs and is of considerable length. Therefore, this impact would be *potentially significant.*

Bald eagle would not be affected by reservoir operations, except that eagle foraging can be enhanced by the shallower water and concentration of fish that occurs during drawdowns.

Other Species of Concern

No plant species of concern would be inundated as a result of Calaveras Reservoir operations under the WSIP. Wildlife species of concern in and near Calaveras Reservoir include western pond turtle, several raptor species that forage in grasslands, songbirds that nest and forage in riparian or marsh habitat, and bat species that roost in riparian habitat or forage over water. Because potential changes to grassland, riparian, and marsh habitats are minor, this impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

Operation of Calaveras Dam and Reservoir under the WSIP would inundate low-diversity, weedy upland vegetation with little habitat value for wildlife. It would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Impacts related to this loss of low-quality habitat would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on sensitive habitats and key special-status species, especially foothill yellow-legged frog. Implementation of Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources, which involves the creation, preservation, and enhancement of wetland habitat elsewhere within the Alameda watershed, including riparian habitat, would reduce this impact to a less-than-significant level.

Impact 5.4.6-2: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek.

Sensitive Habitats

Sensitive habitats in this reach of Alameda Creek include several riparian forest communities, including Central Coast arroyo willow riparian forest, white alder riparian forest, and sycamore alluvial woodland. Most of this reach is a steeply sloping, confined bedrock channel, and the hydrograph is flashy. Most of the structure and species composition of the riparian habitat is the result of conditions that prevailed prior to 2002.

Flow Impacts. After the new Calaveras Dam is fully operational and the Alameda Creek Diversion Dam can be operated to maximum capacity, flows in Alameda Creek below the diversion dam would be reduced in frequency, duration, and magnitude compared with existing conditions. Peak flows would be diminished when the diversion tunnel is open, which would be most of the winter rainfall season. Under the WSIP, sediment would continue to be cleared annually from the diversion dam and transported downstream, much as under existing conditions. Because flow in Alameda Creek is rainfall-based, the receding flows decline rapidly, and the hydrograph pattern is not as important to riparian vegetation as with snowmelt-based systems. Compared with existing conditions, the pattern and duration of minimum flows in Alameda Creek would be about the same.

For the most part, the composition and structure of the existing riparian communities are a function of the flow conditions that prevailed before the DSOD imposed operational restrictions on the reservoir. The existing sycamore alluvial woodland and valley oak woodland formed under unimpaired flow conditions prior to construction of Calaveras Dam in 1925, and the willow and alder riparian forests formed under pre-2002 Calaveras Dam operations. Therefore, it is more useful to assess the impact of the WSIP by comparing future conditions with the conditions under which these riparian communities formed. Under pre-2002 conditions, as much flow as possible was diverted from Alameda Creek into the diversion tunnel, and, under the WSIP, as much flow as possible would again be diverted. The pattern and quantity of flows in Alameda Creek would be nearly the same as under pre-2002 conditions. The slight increase in late-winter flows under some hydrologic year types would not have a detectable effect on riparian habitat. Neither existing nor future conditions appear to be suitable for stand regeneration of sycamore alluvial woodland or valley oak woodland. A return to the pre-2002 pattern of diversions from Alameda Creek would return flow conditions to those under which the riparian forest and scrub formed; therefore, the impact of the WSIP on the extent, structure, composition, and sustainability of these habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

California red-legged frog and foothill yellow-legged frog currently occupy this section of Alameda Creek. Under the WSIP, there would be a substantial reduction in total winter flows compared with existing conditions. Reductions in the highest peak flows could reduce the extent of scouring that removes egg masses and tadpoles, which would be beneficial. However, the general reduction in flow would reduce the total available aquatic breeding habitat for these species and would also reduce the area suitable for producing their food sources, such as benthic macroinvertebrates. Although there could be both beneficial and adverse impacts on habitat for California red-legged frog and foothill yellow-legged frog, the reduction in aquatic breeding habitat would be a *potentially significant* impact.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in this section of Alameda Creek. A number of raptor, songbird, and mammal species of concern could be affected in this section of Alameda Creek. Although the WSIP would reduce flows compared to the existing condition, prevailing habitat conditions are not expected to change because they are more a result of the slightly lower pre-2002 flows. This impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

The more common upland habitats and species would not be affected by WSIP operational changes in this area. In this reach, the WSIP would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Therefore, this impact would *not apply* to common habitats and species.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources due to a potential reduction in aquatic breeding habitat for key special-status species. Measure 5.4.1-2, Diversion Tunnel Operation, calls for operation of the diversion tunnel in a manner that ensures that flows not required to maintain storage in Calaveras Reservoir are passed down Alameda Creek at the diversion dam. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, calls for developing and implementing an operational plan to provide minimum bypass flows below the diversion dam to support habitat for rainbow trout and other native stream-dependent species from December through April. Implementation of these measures would ensure that minimum flows in Alameda Creek are allowed to pass by the diversion dam. Taken together, these measures would reduce adverse impacts on key special-status species to a less-than-significant level.

Impact 5.4.6-3: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek.

Sensitive Habitats

Sensitive habitats in Calaveras Creek below Calaveras Dam consist of riparian habitats such as Central Coast arroyo willow riparian forest and sycamore alluvial woodland. For the most part, Calaveras Creek is situated in a confined canyon with a bedrock channel. In addition to groundwater contributions to flow and input from lateral tributaries, releases from Calaveras under existing conditions consist of several weeks of releases averaging 300 to 400 cfs.

Impacts from Winter Flows. Compared with the existing condition, high-flow winter releases into Calaveras Creek under the WSIP would decrease, especially during normal, above-normal, and wet years. Since 2002, no spills have occurred, but cone valve releases of 325 to 375 cfs have occurred during certain high rainfall periods. The confined bedrock channel already limits channel-forming processes and opportunities for riparian regeneration. The reduction of flows in Calaveras Creek would incrementally reduce suitable habitat for riparian vegetation, but the change would be so small as to be impossible to quantify. As a result, the impact would be less than significant.

Similar to Alameda Creek below the diversion dam, most of the existing riparian habitat is the result of flow conditions that prevailed before December 2001, so pre-2002 flow conditions are considered in this impact analysis. Under the WSIP, spills are projected to occur slightly more frequently, but might be smaller in magnitude relative to pre-2002 operations. Under pre-2002 conditions and under the proposed program, the SFPUC would operate Calaveras Reservoir to retain as much water as operationally feasible, minimizing releases and spills to Calaveras Creek. Although there could be some slight changes in the pattern of releases and spills in Calaveras Creek under the WSIP, the overall pattern and quantity of high winter releases and spills would remain very similar to pre-2002 conditions, and the impact on riparian habitats would be less than significant.

Flows in Calaveras Creek below Calaveras Dam would be altered in two ways during the two- to five-year period when the reservoir is being refilled. First, there would be no cone valve releases into Calaveras Creek below the dam. Second, the SFPUC would initiate required minimum instream flow releases (see Table 5.4.1-9) when construction of the new Calaveras Dam is completed. When flows at the confluence of Alameda and Calaveras Creeks fall below the minimum required flow, generally during protracted dry periods, releases would be made from Calaveras Dam or upstream on Alameda Creek. These releases would ensure that existing riparian habitat would be sustained; therefore, impacts on riparian habitats related to filling the reservoir would be *less than significant*, and no mitigation measures would be required.

Impacts from Minimum Flows. Under the WSIP, minimum flows may be maintained year-round, depending if flow releases are from Calaveras Reservoir or from upstream on Alameda Creek. Sustained minimum flows during the dry season could slightly increase groundwater recharge. It could also facilitate the conversion from riparian habitats that require only seasonally flowing water to those that require permanent flowing water, such as alder riparian forest. This potential replacement of one sensitive riparian habitat with another one (with no change in the total extent of riparian habitat) would be *less than significant*.

Impacts from Changes to Pattern of High-Flow Releases. The proposed new Calaveras Dam would be equipped with several means by which to release large volumes of water into Calaveras Creek, allowing for greater control over released flow levels than at present. Peak releases into Calaveras Creek could be greater than under existing conditions because the improved outlet works would be fully operational, which could enhance channel-forming processes. However, the narrow canyon, confined riparian zone, and bedrock channel are limiting factors. There might be slight changes in the pattern of high-flow releases due to the operational goal of maintaining Calaveras Reservoir as full as feasible. However, these changes would be relatively small and would not substantially alter the dynamics of the riparian habitats in Calaveras Creek. Therefore, impacts on sensitive habitats related to changes in the pattern of high-flow releases would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

Impact of Changed Minimum and High Flows. Potentially affected key special-status species are California red-legged frog and foothill yellow-legged frog, which could breed in Calaveras Creek. No critical habitat is present in Calaveras Creek below Calaveras Dam. Average winter flows under the WSIP would be lower than under existing conditions, especially during wet and above-normal rainfall years, thus reducing the available breeding and foraging habitat. The WSIP would maintain minimum flows year-round, which would be beneficial in providing more sustained aquatic habitat for breeding and foraging. The peak flows might not be greatly reduced and therefore might not reduce entrainment and scouring.

Impact of Changed Pattern of Releases. A description of operational releases has not been developed at the program level. The rate at which flows are increased during releases and the magnitude of recurring controlled releases are important to breeding amphibians; gradual increases in flows allow adults and juveniles to seek sheltered sites, while rapid increases in flow can wash them downstream. The highest flows can cause significant scouring, resulting in losses of egg masses and tadpoles. At the program level, these impacts are conservatively considered *potentially significant*, because the outlet works at Calaveras Dam would have the capacity for greater releases with more rapid ramping up. Depending on the timing and volume of these releases, they could increase the risk of washing away adults, eggs, or tadpoles.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in the vicinity of Calaveras Creek below the reservoir. Potential changes in riparian habitat could result in a minor change in breeding habitat for riparian-nesting birds such as raptors, egrets, and songbird species of concern. Although there could be some change in the structure and species composition of the riparian habitats, the overall extent would not change. Therefore, this impact would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

The WSIP would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant wildlife population to drop below self-sustaining levels. Impacts on common habitats and species would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on terrestrial biological resources in Calaveras Creek, but only with respect to high flows and the resulting loss of frog eggs or egg masses. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases, requires the development of procedures to manage releases from Calaveras Dam so as to minimize habitat impacts and maximize benefits by mimicking the natural regime to the extent possible. The measure would include procedures for increasing and decreasing the rate of releases. With implementation this measure, impacts on terrestrial biological resources in this reach of Calaveras Creek would be reduced to a less-than-significant level.

Impact 5.4.6-4: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek.

Sensitive Habitats

Sensitive riparian communities in this section of Alameda Creek include sycamore alluvial woodland, Central Coast arroyo willow riparian forest, valley oak woodland, and white alder riparian forest. The WSIP would substantially reduce winter flows compared to those under existing conditions (they would be similar to, but slightly muted from, flows in the reach directly below the diversion dam). The change in flows would have no effect on the woodland communities; for stand regeneration, sycamore woodland requires flows similar to unimpaired flows. The slight potential reduction in flows (as it relates to stand regeneration for willow and alder riparian forest) would be offset by increased summer flows under the 1997 MOU. Sustained winter and summer minimum flows could facilitate the conversion of existing riparian habitats, such as sycamore alluvial woodland and valley oak woodland, to alder- and willow-dominated habitats, but the extent of this potential impact would be small. Channel incision is not expected to be an important factor because of the large cobble content of the substrate. Overall, these impacts would offset one another; as a result, the impact on sensitive habitats would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

This section of Alameda Creek supports California red-legged frog and foothill yellow-legged frog. Flow in this section of Alameda Creek would be lower than under existing conditions but higher than under pre-2002 conditions. Impacts on these species could be both beneficial and adverse, depending on annual rainfall and localized site conditions along the creek. Compared with existing conditions, lower winter flows could improve breeding conditions in the short term but reduce the total available breeding habitat and habitat for macroinvertebrate food resources. Compared with pre-2002 conditions, higher winter flows could cause some breeding losses, but would improve long-term habitat conditions because of greater aquatic habitat complexity. Sustained minimum flows would generally provide more consistent breeding habitat. In general, impacts on key special-status species would be both beneficial and adverse and would likely depend on year-to-year conditions and site-to-site conditions within this reach of the creek. Because of the uncertainty, the potential impact of releases on breeding amphibians is considered *potentially significant*. Alameda whipsnake would not be affected by WSIP operations along Alameda Creek.

Other Species of Concern

No plant species of concern would be affected by WSIP operations in this section of Alameda Creek. A less-than-significant change in the structure and diversity of riparian habitat would not substantially alter the extent or quality of breeding habitat for songbirds, raptors, and mammals. The overall impact on habitat would be less than significant, so the impact on species of concern would be *less than significant.* No mitigation measures would be required.

Common Habitats and Species

Common upland habitats would not be affected by changes in stream flows resulting from WSIP operations. Since the overall extent of riparian habitat is expected to be about the same (even if the structure and composition changes), impacts on common species would be *less than significant*. No mitigation measures would be required.

Impact Conclusions

Overall, implementation of the proposed WSIP water supply and system operations would result in *potentially significant* impacts on key special-status species. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases, would require the development of procedures to manage releases from Calaveras Dam so as to minimize amphibian breeding habitat impacts and maximize benefits by mimicking the natural regime to the extent possible. Implementation of this measure would reduce impacts on key special-status species on this reach of Alameda Creek. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek, would ensure adequate flows in Alameda Creek below the diversion dam during December through April. Taken together, these measures would reduce impacts on key special-status species in this portion of Alameda Creek to a less-than-significant level.

Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir.

Sensitive Habitats

Sensitive habitats that could be affected by operations of San Antonio Reservoir include small areas of freshwater marsh and riparian scrub on gently sloping reservoir margins. The maximum reservoir levels would not change. No upland habitats would be affected. As discussed in Section 5.4.1, storage levels at San Antonio Reservoir would drop every fifth year for planned system maintenance. The reservoir would be refilled to typical operating levels within one to two years after the maintenance period. The depth and duration of drawdown would be within the range of historic operating conditions. Thus, WSIP impacts on riparian and freshwater marsh habitat along the margins of San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

[Paragraph has been deleted per responses to comments or staff-initiated text changes (Vol. 7, Chapter 16).]

Key Special-Status Species

WSIP operations at San Antonio Reservoir would not result in impacts on upland habitats, and therefore no impacts on Alameda whipsnake would occur. Key special-status species that could be affected by WSIP operations at San Antonio Reservoir include California red-legged frog and California tiger salamander. However, impacts on riparian scrub and freshwater marsh habitat would be less than significant, and therefore impacts on the habitat of California red-legged frog and California tiger salamander would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

San Antonio Reservoir maximum water surface elevation would not change, and fluctuations in water level that would occur would be within the historic operating range. As noted in the discussion of Calaveras Reservoir, studies of amphibians and breeding birds at a similar reservoir project in Washington State found little change in habitat suitability with relatively minor fluctuations in reservoir elevation. As a result, WSIP-related impacts on other species of concern in San Antonio Reservoir would be *less than significant*, and no mitigation measures would be required.

Finally, waterfowl and other littoral species could be temporarily displaced from preferred habitat during drawdowns; however, the availability of numerous alternative food resources and the minor change in reservoir operations support a determination of a negligible effect.

Common Habitats and Species

No impacts on upland habitats would occur. There could be a slight reduction in the extent of weedy habitat around the periphery of the reservoir below the maximum reservoir elevation. This impact would be *less than significant*, and no mitigation measures would be required.

Impact Conclusions

Overall, impacts on terrestrial biological resources in the San Antonio Reservoir area due to implementation of the proposed WSIP operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek.

Sensitive Habitats

Sensitive habitats along San Antonio Creek include sycamore alluvial woodland and willow scrub and mixed riparian habitats. Releases into San Antonio Creek would be rare, similar to existing conditions. As a result, no change in conditions for riparian and wetland habitats would occur; the impact of the WSIP would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

Any impacts on habitat for key special-status species (e.g., California red-legged frog) would be minimal, and the effect on breeding habitat would be *less than significant*. No mitigation measures would be required.

Other Species of Concern

Due to the lack of change from existing conditions, impacts on common species at risk would be *less than significant*, and no mitigation measures would be required.

Common Habitats and Species

No impacts on common habitats would occur as a result of WSIP changes in the operation of Turner Dam. The operational changes in this reach would not interfere substantially with the movement of any native wildlife species or wildlife nursery sites, nor would it cause a plant or wildlife population to drop below self-sustaining levels. Therefore, this impact would *not apply* to common habitats and species.

Impact Conclusions

Overall, impacts on terrestrial biological resources in San Antonio Creek due to implementation of the proposed WSIP water supply and system operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.6-7: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek.

Sensitive Habitats

Flow in Alameda Creek between San Antonio Creek and Arroyo de la Laguna would be reduced during the winter months, especially during normal and wetter rainfall years. However, changes in flow would be buffered by other stream inputs from this point downstream. Judged against the baseline of current conditions, impacts on riparian and wetland habitats in this reach of Alameda Creek would be *less than significant*, and no mitigation measures would be required.

Key Special-Status Species

There would be little alteration in habitat for identified key special-status species due to WSIP-related operational changes. As a result, impacts on key special-status species would be *less than significant*, and no mitigation measures would be required.

Other Species of Concern

Potential impacts of WSIP operations on species of concern would be *less than significant*, for the same reasons described above for riparian and wetland habitats. No mitigation measures would be required.

Common Habitats and Species

Because flow changes in this reach of Alameda Creek would be minimal during normal to wet years, there would be limited impacts on terrestrial ecological resources. Thus, common habitats and species would not be affected, and this impact would *not apply*.

Impact Conclusions

Overall, impacts on terrestrial biological resources in Alameda Creek below San Antonio Creek due to implementation of the proposed WSIP water supply and system operations would be *less than significant*, and no mitigation measures would be required.

Impact 5.4.6-8: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.

The only plan relevant to proposed WSIP operations is the *Alameda Watershed Management Plan*. The WSIP program as a whole would be consistent with the provisions of this plan, which places priority on resource protection while ensuring that the objective of delivering adequate, high-quality water is met. The SFPUC is currently preparing a habitat conservation plan for the Alameda watershed; however, WSIP operations are not considered in this plan, which covers only existing operations. Therefore, impacts related to conflicts with adopted plans would be *less than significant*.

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5.4.7 Recreational and Visual Resources

Chapter 4, Section 4.12, Recreational Resources, provided a general overview of the park and recreational facilities and resources in the WSIP study area and near proposed facility projects. This section discusses specific recreational resources and activities within the Alameda Creek watershed that could be affected by the proposed water supply and system operations. Thus, the analysis deals primarily with water-related recreation, including fishing, swimming, boating, rafting, or activities such as scenic viewing, walking, hiking, or camping adjacent to water bodies.

5.4.7.1 Setting

The three main water features within the Alameda Creek watershed are San Antonio Reservoir, Calaveras Reservoir, and Alameda Creek. The natural drainage basin for Calaveras Reservoir includes Arroyo Hondo and Calaveras Creek from the southeast and local drainage areas along the west shore of the reservoir. The natural drainage basin for San Antonio Reservoir, which is the same as the watershed for San Antonio Creek, includes the tributary sub-drainage basins for Indian Creek, La Costa Creek, and Williams Gulch. Alameda Creek also receives limited surface flows from Calaveras Creek, Arroyo Hondo, and San Antonio Creek, as well as flows and runoff from tributary drainages in the Diablo Range and Livermore Valley. Farther downstream, Alameda Creek receives additional flows from Arroyo de la Laguna and Vallecitos Creek. The two reservoirs, as well as much of the rest of the Alameda Creek watershed, are located within the SFPUC Alameda watershed. This watershed is described below under Alameda Creek. The visual quality, recreational uses, and facilities associated with each water feature, including both SFPUC-managed and other uses and facilities, are described below (SFPUC, 2001).

Alameda Creek Recreation and Visual Quality

Alameda Creek runs through several local parks, municipalities (including Alameda County), and the cities of Fremont and Union City. Alameda Creek also runs through the Sunol Regional Wilderness and is adjacent to the Vargas Plateau Regional Preserve, Quarry Lakes Regional Recreation Area, and Coyote Hills Regional Park, all of which are operated by the EBRPD. The recreational uses of the creek are described below.

SFPUC Alameda Watershed

The CCSF owns about 30 percent of Alameda Creek's natural watershed (see Figure 5.4.1-1 in Section 5.4.1). The CCSF-owned portion of the Alameda Creek watershed encompasses approximately 36,000 acres of land, with 23,000 acres in Alameda County and 13,000 acres in Santa Clara County (see Figure 5.4.1-2 in Section 5.4.1). Visually, these areas range from steeply sloped, heavily vegetated semi-wilderness areas to industrialized and gravel mining areas in developed valleys. The CCSF leases some of its upper watershed land to the East Bay Regional Park District (EBRPD) for public recreational use, as described below. Public access to interior parts of the CCSF-owned watershed lands, including stretches of Alameda Creek, is prohibited because of the risk of fire and potential degradation of water quality and natural resources. The creek within these watershed lands is therefore not used for boating, fishing, swimming, or other water-related recreation. However, the SFPUC, which manages the watershed lands, does allow access to some internal fire roads and trails by permit for research or educational purposes to groups accompanied by volunteer leaders (SFPUC, 2001; 2007).

Sunol Water Temple. The Sunol Water Temple, a pavilion and temple situated over a convergence of the infiltration galleries and the downstream end of the defunct Pleasanton-Sunol pipeline, is located within the SFPUC Alameda watershed and adjacent to Alameda Creek. The temple is a destination for picnickers and tourists as a scenic and historic landmark and is open to the public at specified hours. It is also available for public events by SFPUC permit (SFPUC, 2001).

Sunol Regional Wilderness

The 6,858-acre Sunol Regional Wilderness, part of the Sunol-Ohlone Regional Park managed by the EBRPD, lies between San Antonio Reservoir and Calaveras Reservoir, with Alameda Creek running along its eastern edge (see Figure 4.12-1, in Section 4.12). A portion of the Sunol Regional Wilderness is located on SFPUC Alameda watershed lands leased by the EBRPD. Aesthetically, this parkland is comprised of undeveloped canyon, streamside, and ridgeline areas; some of the ridges offer expansive views of the surrounding areas.

The Sunol Regional Wilderness includes more than 26 miles of hiking, equestrian, and biking trails, including the Ohlone Wilderness Regional Trail (see below). Facilities and programs include picnic areas, barbeque pits, group and backpack camps, a visitor’s center, naturalist-led activities, and equestrian facilities. At least one camping area is situated next to Alameda Creek. Little Yosemite, a scenic gorge on Alameda Creek, is located within the Sunol Regional Wilderness. Swimming is permitted within the wilderness area, except in Little Yosemite. Other water sports, including boating, rafting, and canoeing, are generally not feasible in this portion of Alameda Creek due to the creek’s water level, and fishing is not allowed in creek (EBRPD, 2007a).

Ohlone Wilderness Regional Trail

The Ohlone Wilderness Regional Trail, managed by the EBRPD, is a 28-mile trail for hikers and equestrians (no bicycles or motor vehicles are permitted) that stretches across and connects four regional parks and wilderness areas, including Ohlone Regional Wilderness, Mission Peak Regional Preserve, Sunol Regional Wilderness, and Del Valle Regional Park. It also passes through two watershed areas leased from the CCSF. The trail crosses Alameda Creek within the Sunol Regional Wilderness. This trail affords both secluded canyon views and expansive ridge-top vistas.

Alameda Creek Regional Trail

The Alameda Creek Regional Trail follows the banks of Alameda Creek in southern Alameda County from the mouth of Niles Canyon (in the Niles District of Fremont) westward to San Francisco Bay for a distance of 12 miles. The trail runs on both sides of the creek; on the north side of the creek, it is an unpaved trail for pedestrians, equestrians, and cyclists, and on the south side is a paved trail for pedestrians and cyclists only. Motor vehicles are not allowed on the trail. This trail includes views of both semi-natural and urban landscapes.

The trail is accessible from several thoroughfares in the Fremont, Union City, and Newark areas. It provides access to Coyote Hills Regional Park (from the south side of the creek only) and

Quarry Lakes Regional Recreation Area (from both sides of the creek). The Alameda Creek Stables Staging Area, Beard Staging Area, Isherwood Staging Area, and Niles Staging Area are stationed along the trail, providing facilities such as restrooms, picnic areas, and drinking fountains (EBRPD, 2007b).

Vargas Plateau Regional Preserve

The Vargas Plateau Regional Preserve, managed by the EBRPD, is located adjacent to the SFPUC Alameda watershed along a common boundary line on the east side of the preserve. Its northern boundary touches Alameda Creek for a distance of about 2,500 feet. A portion of the decommissioned Sunol Aqueduct crosses the park within a utility easement. Currently, the preserve is not suitable for active public use due to the lack of public road access, the need to protect natural or man-made resources, and other factors related to public safety and access. The EBRPD is currently in the process of adopting the *Vargas Plateau Regional Park Land Use Plan*, which would create a regional park that provides trails, outdoor recreation, campgrounds, and nature appreciation areas (EBRPD, 2007e).

Quarry Lakes Regional Recreation Area

Quarry Lakes Regional Recreation Area, managed by the EBRPD, borders the north side of Alameda Creek for approximately 1.8 miles in the city of Fremont. The Alameda Creek Trail is accessible from several points in the recreation area. The recreation area has several lakes; public access is provided to these lakes for fishing, swimming, and boating (EBRPD, 2007c). The lakes afford open-space and water-feature views for park users.

Coyote Hills Regional Park

Coyote Hills Regional Park, managed by the EBRPD, borders the south side of Alameda Creek for approximately 1.1 miles in the city of Fremont (see Figure 4.12-1 in Section 4.12). The Alameda Creek Trail is accessible from several points in the park. The park provides naturalist programs, a visitor center, group campgrounds, several miles of trails, cultural artifact displays, and a boardwalk through marshlands. Nature viewing and hiking are encouraged within the park (EBRPD, 2007d).

Don Edwards San Francisco Bay National Wildlife Refuge

The Don Edwards San Francisco Bay National Wildlife Refuge borders Alameda Creek as it approaches San Francisco Bay (see Figure 4.12-1 in Section 4.12). The wildlife refuge, managed by the USFWS, includes trails and nature viewing. One of the refuge's stated goals is to provide opportunities for wildlife-oriented recreation and nature study (USFWS, 2007). The wildlife refuge provides views of the bay and associated wetland areas as well as of the nearby salt ponds.

Other Access to Alameda Creek

Other recreational facilities in Fremont and Union City that either abut or provide access to Alameda Creek and the Alameda Creek Trail include Shinn Pond, Niles Community Park, Kaiser Pond, the Model Mariners boat club, Rancho Arroyo Park, William Cann Park, and David Jones Park (EBRPD, 2007b).

San Antonio and Calaveras Reservoirs

San Antonio and Calaveras Reservoirs are located entirely within the SFPUC Alameda watershed. As mentioned above, public access to interior parts of the Alameda watershed lands is prohibited, and the reservoirs are not available for water-related recreation; however, the SFPUC does allow access to some internal fire roads and trails by permit for research or educational purposes to groups accompanied by volunteer leaders (SFPUC, 2001). Both reservoirs appear as visually prominent water features in views from surrounding ridges.

Regulatory Considerations

As discussed in Chapter 4, Section 4.2, Plans and Policies, the *Alameda Watershed Management Plan* includes the following policy related to visual quality:

- *Policy WA 9*: If new facilities require additional new locations, require that view shed studies be conducted to minimize, eliminate or conceal the violation of scenic values.

However, the WSIP water supply and system operations analyzed in this section would not require any new facilities, other than those already discussed and analyzed in Section 4.3, Land Use and Visual Quality. Therefore, this policy is not addressed further in this section.

5.4.7.2 Impacts

Significance Criteria

The CCSF has not formally adopted significance standards for impacts related to recreational or visual resources, but generally considers that implementation of the proposed program would have a significant impact on these resources if it were to:

Recreation

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated (Secondary impacts of growth are evaluated in Chapter 7, Growth-Inducement Potential and Indirect Effects of Growth)
- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment (Secondary impacts of growth are evaluated in Chapter 7)
- Physically degrade existing recreational resources

The physical degradation of existing resources could occur if the WSIP were to: (1) remove or damage existing recreational resources; (2) cause environmental impacts (such as air quality or noise effects) that would indirectly cause a deterioration in the quality of the recreational experience; or (3) disrupt access to existing recreational facilities (which would divide a community from some of the established amenities used by its members).

Visual Quality

- Have a substantial adverse effect on a scenic vista
- Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and other features of the built or natural environment that contribute to a scenic public setting
- Substantially degrade the existing visual character or quality of the site and its surroundings

Approach to Analysis

The WSIP would change water levels in reservoirs and alter flow in streams in the Alameda watershed. WSIP-induced changes in reservoir water levels and stream flow in the Alameda Creek watershed were estimated using the HH/LSM (see Appendix H). WSIP-induced changes in reservoir water levels and stream flow were estimate semi-quantitatively. A specialist in recreational and visual resources assessed the impacts of the WSIP on these environmental elements based on the estimated WSIP-induced changes in reservoir water levels and stream flow (see Section 5.4.1).

Impact Summary

Table 5.4.7-1 presents a summary of the impacts on recreational and visual resources in the Alameda Creek watershed that could result from implementation of the proposed water supply and system operations.

TABLE 5.4.7-1
SUMMARY OF IMPACTS –
RECREATIONAL AND VISUAL RESOURCES IN THE ALAMEDA CREEK WATERSHED

Impact	Significance Determination
Impact 5.4.7-1: Effects on recreational facilities and/or activities	LS
Impact 5.4.7-2: Visual effects on scenic resources or the visual character of water bodies	LS

LS = Less than Significant impact, no mitigation required

Impact Discussion

Impact 5.4.7-1: Effects on recreational facilities and/or activities.

The WSIP would not affect water-related recreational facilities or activities in the Alameda Creek watershed. As described above in Section 5.4.7.1, Setting, water recreation is not allowed on the SFPUC reservoirs; because there would be no change to this policy under the WSIP, impacts on recreation would not occur as a result of water level changes in the reservoir. With respect to recreation in and along the creeks in the watershed there is either: (1) no or only very limited water recreation occurring at present, and/or (2) the WSIP-related flow changes described in Section 5.4.1 would not change creek flows to an extent that existing recreational use would be affected. The proposed program would reduce peak flows along Alameda Creek in the Sunol Regional Wilderness in the winter and early spring months. The reduced flows would somewhat degrade the recreational experience for hikers on the trails near (or with views of) Alameda Creek, however, with the proposed minimum flows for resident trout on Alameda Creek to be released from the Alameda Creek Diversion Dam when such flows are present, this would be a *less-than-significant* impact.

Impact 5.4.7-2: Visual effects on scenic resources or the visual character of water bodies.

As described in Section 5.4.1, changes in stream flow and reservoir water levels under the WSIP are not beyond the range of flow and water level variation that occurs now. The reductions in peak flows in average, above-average, and wet years under the proposed program would not be visually apparent to most recreational users and others viewing the creeks and reservoirs. The main exception would be the reductions in peak flows in Alameda Creek in the Sunol Regional Wilderness, including the scenic Little Yosemite area, during winter and spring months. Reduced peak flows in Alameda Creek in the Little Yosemite area would somewhat degrade the visual character Alameda Creek, however, with the proposed minimum flows for resident trout on Alameda Creek to be released from the Alameda Creek Diversion Dam when such flows are present, this would be a *less-than-significant* impact.

Proposed summer releases to support fisheries would increase flows in Calaveras Creek and downstream in Alameda Creek and would have a beneficial visual effect, because the releases would enhance the creek's appearance in the summer months when recreational use is highest. Therefore, no significant adverse visual impacts would occur, and no mitigation is required.

References – Recreational and Visual Resources

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