Chapter 6
Hydrology, Hydraulics, and Water Management

6.1 Affected Environment

This affected environment section first presents background information and then describes storage and diversion facilities, and hydrology, hydraulics, and water management (H&H), including flood management, south Delta water levels, and groundwater resources. For a more in-depth description of the affected environment, see the *Hydrology, Hydraulics, and Water Management Technical Report*.

6.1.1 Storage Facilities

Facilities described below include Shasta Dam and Powerplant, Keswick Dam and Powerplant, and Anderson-Cottonwood Irrigation District Diversion Dam.

Shasta Lake and Vicinity

This section describes storage facilities in the Shasta Lake area.

Shasta Dam and Powerplant Shasta Dam is a curved, gravity-type, concrete structure that rises 533 feet above the streambed with a total height above the foundation of 602 feet. The dam has a crest width of about 41 feet and a length of 3,460 feet. Shasta Reservoir has a storage capacity of 4,550,000 acre-feet, and water surface area at full pool of 29,600 acres. Maximum seasonal flood management storage space in Shasta Reservoir is 1.3 million acre-feet (MAF). Releases from Shasta Dam can be made through the powerplant, over the spillway, or through the river outlets. The powerplant has a maximum release capacity of nearly 20,000 cubic feet per second (cfs), the river outlets can release a maximum of 81,800 cfs at full pool, and the maximum release over the drum-gated spillway is 186,000 cfs.

Upper Sacramento River (Shasta Dam to Red Bluff)

This section describes storage facilities along the Upper Sacramento River.

Keswick Dam and Powerplant Keswick Dam is about 9 miles downstream from Shasta Dam. In addition to regulating outflow from the dam, Keswick Dam controls runoff from 45 square miles of drainage area. Keswick Dam is a concrete, gravity-type structure with a spillway over the center of the dam. The spillway has four 50- by 50-foot fixed wheel gates with a combined discharge capacity of 248,000 cfs at full or full pool elevation (587 feet). Storage capacity below the top of the spillway gates at full pool is 23,800 acre-feet. The powerplant has a nameplate generating capacity of 105,000 kilowatts and can pass about 15,000 cfs at full pool.

6.1.2 Diversion Facilities

Below Keswick Dam, two facilities divert flows from the Sacramento River, the Anderson-Cottonwood Irrigation District Diversion Dam and Red Bluff Pumping Plant (RBPP). The primary purpose of these two facilities is to divert water into canals for local agricultural use.

In the Delta, the CVP and SWP primarily make diversions through two pumping plants, the CVP C.W. "Bill" Jones Pumping Plant (Jones) and the SWP Harvey O. Banks Pumping Plant (Banks). These two pumping plants supply water to the CVP/SWP service areas south of the Delta. Although other diversion facilities are located between RBPP and the Delta, they would have less of an effect on project operations than those discussed above.

6.1.3 Hydrology and Hydraulics

The Sacramento Valley contains the Sacramento, Feather, and American river basins, covering an area of more than 24,000 square miles in the northern portion of the Central Valley. The Sacramento Valley encompasses three major drainage basins; the McCloud River, Pit River, and Sacramento River in the north; the Delta in the south; the Sierra Nevada Mountains and Cascade Ranges in the east; and the Coast Range and Klamath Mountains in the west. Drainage in the northern portion of the Central Valley is provided by the Sacramento, Feather, and American rivers, and major and minor streams and rivers that drain the east and west sides of the valley.

Shasta Lake and Vicinity

The most northern portion of the Sacramento River basin, upstream from Shasta Dam, is drained by the Pit River, the McCloud River, Squaw Creek, and the headwaters of the Sacramento River.

The four major tributaries to Shasta Lake are the Sacramento River, McCloud River, Pit River, and Squaw Creek, in addition to numerous minor tributary creeks and streams.

Upper Sacramento River (Shasta Dam to Red Bluff)

Flows in the Sacramento River in the 65-mile reach between Shasta Dam and Red Bluff (River Mile (RM) 244) are regulated by Shasta Dam and are reregulated downstream at Keswick Dam (RM 302). In this reach, flows are influenced by tributary inflow. Major west side tributaries to the Sacramento River in this reach of the river include Clear and Cottonwood creeks. Major east side tributaries to the Sacramento River in this reach of the river include Battle, Bear, Churn, Cow, and Paynes creeks.

Lower Sacramento River and Delta

The Sacramento River enters the Sacramento Valley about 5 miles north of Red Bluff. From Red Bluff to Chico Landing (52 miles), the river receives flows from Antelope, Mill, Deer, Big Chico, Rock, and Pine creeks on the east side and Thomes, Elder, Reeds, and Red Bank creeks on the west side. From Chico Landing to Colusa (50 miles), the Sacramento River meanders through alluvial deposits between widely spaced levees. Stony Creek is the only major tributary in this segment of the river. No tributaries enter the Sacramento River between Stoney Creek and its confluence with the Feather River.

Floodwaters in the Sacramento River overflow the east bank at three sites in a reach referred to by the State as the Butte Basin Overflow Area. In this river reach, several Federal projects begin, including the Sacramento River Flood Control Project, Sacramento River Major and Minor Tributaries Project, and Sacramento River Bank Protection Project. Levees of the Sacramento River Flood Control Project begin in this reach, downstream from Ord Ferry on the west (RM 184), and downstream from RM 176 above Butte City on the east side of the river.

Shasta Reservoir also is operated to meet a flow requirement in the Sacramento River, at Wilkins Slough near Grimes (RM 125), also known as the Navigation Control Point. Downstream from Wilkins Slough, the Feather River, the largest east side tributary to the Sacramento River, enters the river just above Verona. Between Wilkins Slough and Verona, floodwater is diverted at two places in this segment of the river—Tisdale Weir into the Tisdale Bypass and Fremont Weir into the Yolo Bypass. The bypass system routes floodwater away from the mainstem Sacramento River to discharge into the Delta.

Below Verona, the Sacramento River flows 79 miles to the Delta, passing the City of Sacramento. The Yolo Bypass parallels this river reach to the west. Flows enter this river reach at various points. First, flows from the Natomas Cross Canal enter the Sacramento River approximately 1 mile downstream from the Feather River mouth. The American River flows into the Sacramento River in the City of Sacramento. When Sacramento River system flood flows are the highest, a portion of the flow is diverted into the Yolo Bypass at the Sacramento Weir, about 3 miles upstream from the American River confluence in downtown Sacramento. At the downstream end, Yolo Bypass flows reenter the Sacramento River near Rio Vista. As the river enters the Delta, Georgiana Slough branches off from the mainstem of the Sacramento River, routing a portion of the flow into the central Delta.

The hydraulics of the Delta are complicated by tidal influences, a multitude of agricultural and municipal and industrial (M&I) diversions for use within the Delta itself, and by CVP and SWP exports. The principal factors affecting Delta hydrodynamics are (1) river inflow and outflow from the Sacramento River and San Joaquin River systems, (2) daily tidal inflow and outflow through San

Francisco Bay, and (3) export pumping from the south Delta, primarily through the Jones and Banks pumping plants.

The Jones Pumping Plant consists of six pumps, with a maximum export capacity of 4,600 cfs during the irrigation season, and 4,200 cfs during the winter nonirrigation season. Limitations at the Jones Pumping Plant are the result of a Delta-Mendota Canal freeboard constriction near O’Neill Forebay and current water demand in the upper sections of the Delta-Mendota Canal. The Jones Pumping Plant is at the end of an earth-lined intake channel about 2.5 miles long.

The Banks Pumping Plant supplies water for the South Bay Aqueduct and the California Aqueduct, with an installed capacity of 10,300 cfs. Under current operational constraints, exports from Banks Pumping Plant generally are limited to a daily average of 6,680 cfs, except between December 15 and March 15, when exports can be increased by 33 percent of San Joaquin River flow. The Banks Pumping Plant exports water from the Clifton Court Forebay, a 31,000-acre-foot reservoir that provides storage for off-peak pumping, and moderates the effect of the pumps on the fluctuation of flow and stage in adjacent Delta channels.

The Contra Costa Water District (CCWD) supplies CVP water to its users via a pumping plant at the end of Rock Slough. The Rock Slough diversion capacity of 350 cfs gradually decreases to 22 cfs at the terminus. CCWD also constructed and operates the 160,000-acre-foot Los Vaqueros Reservoir, which has intakes and pumping plants on the Old River and Victoria Canal for diverting surplus Delta flows to reservoir storage or contract water to CCWD users. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. Excess outflow occurs almost entirely during the winter and spring months. Average winter outflow is about 32,000 cfs, while the average summer outflow is 6,000 cfs.

CVP/SWP Service Areas

This section describes the hydrology and hydraulics of the CVP/SWP service areas, located south of the primary study area.

Downstream from the Jones Pumping Plant, CVP water flows in the Delta-Mendota Canal and can be either diverted by the O’Neill Pumping-Generating Plant into the O’Neill Forebay or can continue down the Delta-Mendota Canal for delivery to CVP contractors. The O’Neill Pumping-Generating Plant consists of six pump-generating units, with a capacity of 700 cfs each.

The O’Neill Forebay is a joint CVP/SWP facility, with a storage capacity of about 56,000 acre-feet. In addition to its interactions with the Delta-Mendota Canal via the O’Neill Pumping-Generating Plant, it is a part of the SWP California Aqueduct. The O’Neill Forebay serves as a regulatory body for San

Luis Reservoir; the William R. Gianelli Pumping-Generating Plant, also a joint CVP/SWP facility, can pump flows from the O'Neill Forebay into San Luis Reservoir and also make releases from San Luis Reservoir to the O'Neill Forebay for diversion to either the Delta-Mendota Canal or the California Aqueduct. Also, several water districts receive diversions directly from the O'Neill Forebay. The William R. Gianelli Pumping-Generating Plant consists of eight units, with 1,375 cfs of capacity each.

San Luis Reservoir provides offstream storage for excess winter and spring flows diverted from the Delta. It is sized to provide seasonal carryover storage, with a total capacity of 2,027,840 acre-feet. The CVP share of the storage is 965,660 acre-feet; the remaining 1,062,180 acre-feet are the SWP share. During spring and summer, water demands and schedules are greater than the capability of Reclamation and DWR to pump water from the Jones and Banks pumping plants; water stored in San Luis Reservoir is used to make up the difference. The CVP share of San Luis Reservoir typically is at its lowest in August and September, and at its maximum in April. The San Felipe Division of the CVP supplies water to customers in Santa Clara and San Benito counties from San Luis Reservoir. The operation of San Luis Reservoir has the potential to affect the water quality and reliability of these supplies if reservoir storage drops below 300 thousand acre-feet (TAF).

South of the O'Neill Forebay, the Delta-Mendota Canal terminates in the Mendota Pool, about 30 miles west of Fresno. From the Delta-Mendota Canal, the CVP makes diversions to multiple water users and refuges. Delta-Mendota Canal capacity at the terminus is 3,211 cfs. Parallel to the Delta-Mendota Canal, the San Luis Canal-California Aqueduct is a joint-use facility for the CVP and SWP. It begins on the southeast edge of the O'Neill Forebay and extends about 101.5 miles southeasterly to a point near Kettleman City. Water from the canal serves the San Luis Federal service area, mostly for agricultural purposes and for some M&I uses. The canal has a capacity ranging from 8,350 cfs to 13,100 cfs.

South of Banks Pumping Plant, the California Aqueduct flows into Bethany Reservoir, a 5,000-acre-foot forebay for the South Bay Pumping Plant. Exiting the Bethany Forebay, the California Aqueduct flows through a series of checks to the aforementioned O'Neill Forebay, and is either pumped into San Luis Reservoir or released to the San Luis Canal, the CVP/SWP joint-use portion of the California Aqueduct. Deliveries are made from the California Aqueduct to agricultural and M&I contractors.

6.1.4 Surface Water Supply

Although water supply reliability is one of the two primary planning objectives of the SLWRI, operations for Shasta Reservoir primarily are focused on delivering water supply to CVP contractors. However, because of the interconnectivity of the CVP and SWP, water supply operations of the SWP could be affected by changes in operations of the CVP associated with the SLWRI.

CVP/SWP Service Areas

This section describes surface water supply to CVP and SWP contractors.

CVP Contractors At certain times of the year, operations of Shasta Reservoir are driven by water supply needs of the CVP contractors. The CVP provides water to settlement contractors in the Sacramento Valley, exchange contractors in the San Joaquin Valley, agricultural and M&I water service contractors in both the Sacramento and San Joaquin valleys, and wildlife refuges both north and south of the Delta. At the beginning of each year, Reclamation evaluates hydrologic conditions throughout California and uses this information to forecast CVP operations, and to estimate the amount of water to be made available to the Federal water service contractors for the year.

The majority of the Federal water service contractors have service areas located south of the Delta. In general, allocations to CVP water service contractors south of the Delta are lower than allocations to service contractors in the Sacramento Valley. Because of water rights secured before construction of the CVP, Sacramento Valley settlement contractors and San Joaquin Valley exchange contractors have a higher level of reliability for their supplies; except in extremely dry years, when the water year type, as defined by the Shasta Hydrologic Index, is classified as critical, settlement and exchange contractors receive 100 percent of their contract amounts. In Shasta critical years, settlement and exchange contractors receive 75 percent of their contract amounts. A Shasta critical year is defined as a year when the total inflow to Shasta Reservoir is below 3.2 MAF, or the average inflow for a 2-year period is below 4.0 MAF and the total 2-year deficiency for deliveries is higher than 0.8.

SWP Contractors The CVP and SWP are intrinsically linked through the Delta; shared responsibilities under their respective water rights and coordinated operations agreements mean that a change in flow from one project could result in a flow change from the other. Accordingly, SWP water supply operations are discussed below.

The SWP operates under long-term contracts with public water agencies throughout California. These agencies, in turn, deliver water to wholesalers or retailers, or deliver it directly to agricultural and M&I water users (DWR 1999). The SWP contracts between DWR and individual State water contractors define several classifications of water available for delivery under specific circumstances.

6.1.5 Flood Management

This section describes major features of the flood management system in the primary and extended study areas, including reservoirs, levees, weirs, and bypasses. Historical operation of these facilities also is described.

Shasta Lake and Vicinity

Releases from Shasta Dam often are made for flood management. Releases for flood management occur either in the fall, beginning in early October, to reach the prescribed vacant flood space, or to evacuate space during or after a storm event to maintain the prescribed vacant flood space in the reservoir. During a storm event, releases for flood management occur either over the spillway during large events or through river outlets for smaller events. Between 1950 and 2006, flows over the spillway occurred in 12 years, or in 21 percent of years. During the same time interval, releases for flood management (either for seasonal space evacuation or during a flood event, and including spills over the spillway) occurred in about 37 years, or nearly 70 percent of the years.

Upper Sacramento River (Shasta Dam to Red Bluff)

Historically, the largest flood events along the upper Sacramento River have been from heavy rainfall, with a relatively smaller component of the flows coming from snowmelt in the upper basin. Flood management operations at Shasta Dam include forecasting runoff into Shasta Lake as well as runoff of unregulated creek systems downstream from Keswick Dam. A critical component of upper Sacramento River flood operations is the forecast of local runoff entering the Sacramento River between Keswick Dam and Bend Bridge near Red Bluff.

The unregulated creeks (major tributaries include Cottonwood, Cow, and Battle creeks) discharging into the Sacramento River between Keswick Dam and Bend Bridge can produce high runoff rates into the Sacramento River in short periods of time. During large flood events, the local runoff between Keswick Dam and Bend Bridge can exceed 100,000 cfs.

Lower Sacramento River and Delta

Flood management facilities along the lower Sacramento River and in the Delta include the levees, weirs, and bypasses of upper and lower Butte basin, the Sacramento River between Colusa and Verona, and the Sacramento River between Verona and Collinsville. The levees, weirs, and bypasses are features of the Sacramento River Flood Control Project, which began operation in the 1930s and was significantly expanded in the 1950s.

When Sacramento River flows exceed between 90,000 and 100,000 cfs at Ord Ferry, water flows naturally over the banks of the river into Butte basin. In addition to the Sacramento River overbank flows at Ord Ferry, the basin receives inflow over the Colusa and Moulton weirs and from tributary streams draining from the northeast, principally Cherokee Canal and Butte Creek. Before construction of the Feather River levees, Butte basin also received overflows from the Feather River north of the Sutter Buttes. Outflows from Butte basin move through the Sutter Bypass when the Sacramento River is high or through the Butte Slough outfall gates (RM 139) into the Sacramento River when the river is low.

The Sacramento River meanders through the 64 miles between Colusa (RM 143) and Verona (RM 79). The levee system continues along both sides of this river reach. The levee spacing (or channel width), east to west, is wider between the upstream sections, from RM 176 to RM 143 at Colusa, than the levee spacing downstream from Colusa. The Feather River, the largest east side tributary to the Sacramento River, enters the river just above Verona. Flood management diversions occur at two places in this segment of the river, at the Tisdale Weir and Fremont Weir.

Below Verona, the Sacramento River flows 79 miles to Collinsville, at the mouth of the Delta, passing the City of Sacramento along the way. The Yolo Bypass parallels this river reach to the west. Flows enter this river reach at various points. First, flows from the Natomas Cross Canal enter the Sacramento River approximately 1 mile downstream from the Feather River mouth (RM 80). The American River (RM 60), the southernmost major Sacramento River tributary, enters the river at the City of Sacramento. Flows in the Yolo Bypass reenter the river near Rio Vista (RM 12). As the river enters the Delta, Georgiana Slough branches off from the mainstream Sacramento River, routing flows into the central Delta. The one diversion point for flood management is at Sacramento Weir, where floodwaters are diverted from the Sacramento River through the Sacramento Bypass to the Yolo Bypass under the highest flow conditions.

CVP/SWP Service Areas

This section describes flood management facilities in the CVP/SWP service areas by river basin, including the Feather River, American River, San Joaquin River, and east side tributaries to the Delta (i.e., Littlejohns Creek, Calaveras River, and Mokelumne River).

The primary flood management feature of the Feather River basin is Oroville Reservoir, with a flood management reservation volume of 750 TAF. Oroville Reservoir releases are used to help meet the objective flow on the Feather River of 150,000 cfs, and in conjunction with New Bullards Bar Reservoir on the Yuba River, to meet an objective flow below the Yuba River confluence of 300,000 cfs. Levees line the Feather River from its confluence with the Sacramento River to the City of Oroville (RM 63).

The lower American River is primarily protected from flooding by Folsom Dam. The Folsom Reservoir flood management reservation volume is variable, ranging from 400 TAF to 670 TAF. The objective release on the American River is 115,000 cfs; however, some damage to infrastructure along the American River occurs at flows above 20,000 cfs. The American River is leveed from its confluence with the Sacramento River to near the Carmichael Bluffs on the north bank, and to near the Sunrise Boulevard Bridge on the south bank (RM 19).

The San Joaquin River basin is protected by an extensive reservoir system, including the following:

- Friant Dam and Millerton Lake (RM 270), with a flood management reservation volume of 170 TAF
- Big Creek Dam, on Big Creek, with a flood management reservation of 30.2 TAF
- Hidden Dam and Hensley Lake on the Fresno River, with a flood management reservation of 65 TAF
- Buchanan Dam and H.V. Eastman Lake on the Chowchilla River, with a flood management reservation of 45 TAF
- Los Banos Detention Dam on Los Banos Creek, with a flood management reservation of 14 TAF
- Merced County Stream Group Project, consisting of five dry dams (i.e., Bear, Burns, Owens, Mariposa, and Castle) and two diversion structures, with a total flood storage capacity of 30.5 TAF
- New Exchequer Dam and Lake McClure on the Merced River, with a flood management reservation of 350 TAF
- Don Pedro Dam and Lake on the Tuolumne River, with a flood management reservation of 340 TAF
- New Melones Dam and Lake on the Stanislaus River, with a flood management reservation of 450 TAF

The streams in the northern portion of the San Joaquin River basin, between the American and Stanislaus rivers, commonly are referred to as the eastside tributaries to the Delta. These rivers flow into the San Joaquin River within the boundaries of the Delta. Flood management features on the eastside tributaries to the Delta include the following:

- Farmington Dam and Reservoir on Littlejohns Creek, with a flood management reservation of 52 TAF
- New Hogan Dam and Lake on the Calaveras River, with a flood management reservation of 165 TAF
- Camanche Dam and Reservoir on the Mokelumne River, with a flood management reservation of 200 TAF

6.1.6 South Delta Water Levels

This section discusses the variability of water levels in the south Delta, as part of CVP/SWP operations in the extended study area.

In the south Delta, decreases in water levels resulting from CVP and SWP export pumping are a concern for local agricultural diverters because, during periods of low water levels, sufficient pump draft cannot be maintained and irrigation can be interrupted. Historically, the highest minimum stage in the Middle River typically occurs in February and is about 0.1 foot below mean sea level (msl). The lowest minimum stage typically occurs in August and is about 0.8 foot below msl. During dry and critical years,[1] under existing conditions, the highest minimum stage in the Middle River typically occurs in April and is about 0.6 foot below msl. The lowest minimum stage typically occurs in September and is about 0.7 foot below msl (CALFED 2000a).

6.1.7 Groundwater Resources

The use and sustainable management of groundwater resources is an important component in meeting water demands in California. Information specific to groundwater resources includes groundwater levels and budget and groundwater quality.

Shasta Lake and Vicinity

Shasta Lake and vicinity are located in the foothill area northwest of the Redding groundwater basin. Small groundwater basins underlying Shasta Lake and vicinity do not have significant groundwater availability for use as a source of supply (Shasta County Water Agency 1998). Groundwater basins underlying Shasta County include the Fall River Valley groundwater basin, Lake Britton groundwater basin, and North Fork Battle Creek. Of these three groundwater basins, the Fall River Valley groundwater basin covers the largest area (54,800 acres) and groundwater extraction for agricultural use in this basin is the highest (approximately 19,000 acre-feet). Estimated groundwater extraction for M&I use in these subbasins ranges from 5 acre-feet to 240 acre-feet. Deep percolation from applied water is minor, ranging from 10 acre-feet to 4,800 acre-feet. Groundwater quality in Shasta Lake and vicinity typically is good. Total dissolved solids (TDS) concentrations in the Fall River Valley groundwater basin are low, ranging from 115 to 232 milligrams per liter (mg/L).

Upper Sacramento River (Shasta Dam to Red Bluff)

The upper Sacramento River portion of the study area extends from Redding to Red Bluff and includes the Redding groundwater basin and the northern portion of the Sacramento groundwater basin.

The Redding groundwater basin underlies most of the upper Sacramento River area between Shasta Dam and Red Bluff. The basin is bordered on the north,

[1] Throughout this document, water year types are defined according to the Sacramento Valley Index Water Year Hydrologic Classification unless specified otherwise.

east, and west by foothills, and on the south by the Sacramento Valley groundwater basin (Tehama 1996). The foothill areas that constitute the eastern and western portions of Shasta and Tehama counties, adjacent to the Redding groundwater basin, are designated as "highland" areas, noted for their relative scarcity of groundwater resources. DWR Bulletin 118 (2003b) subdivides the Redding groundwater basin into six subbasins: Anderson, Enterprise, Millville, Rosewood, Bowman, and South Battle Creek.

The Sacramento groundwater basin extends from the Redding groundwater basin to the San Joaquin Valley, and includes Tehama, Glenn, Butte, Yuba, Colusa, Placer, and Yolo counties.

In general, groundwater flows southeasterly on the west side of the Redding groundwater basin and southwesterly on the east side, toward the Sacramento River (Reclamation and DWR 2003). Historically, groundwater levels in the Redding groundwater basin have remained relatively stable, with no apparent long-term trend of declining or increasing levels. Generally, groundwater levels have a seasonal fluctuation of approximately 2 to 15 feet (Reclamation and DWR 2003). DWR has estimated the total quantity of groundwater storage in the Redding groundwater basin at approximately 6.9 MAF (Reclamation and DWR 2003).

In the northern portion of the Sacramento groundwater basin, the following three subbasins are included in upper Sacramento River portion of the primary study area: Red Bluff, Antelope, and Bend subbasins. Groundwater extraction in the Red Bluff subbasin is nearly 90,000 acre-feet.

Groundwater in the Redding area is of good quality, as shown by low TDS concentrations, ranging from 70 to 360 mg/L. This range is below the U.S. Environmental Protection Agency and California Environmental Protection Agency secondary drinking water standard of 500 mg/L, and also below the agricultural water quality goal of 450 mg/L. Areas of high salinity and poor quality are generally found on the basin margins where groundwater is derived from marine sedimentary rock (Reclamation and DWR 2003).

Groundwater quality in the Sacramento groundwater basin is generally good and sufficient for agricultural and M&I uses, with TDS levels ranging from 200 to 500 mg/L (Reclamation and DWR 2003). Localized groundwater quality issues occur as a result of natural water quality impairments at the north end of the Sacramento Valley, where marine sedimentary rocks containing brackish to saline water are near the surface (Reclamation and DWR 2003).

Lower Sacramento River and Delta

The groundwater basins underlying the lower Sacramento River and Delta areas include the Sacramento Valley groundwater basin, and North and South San Joaquin Valley groundwater basins.

In the Sacramento groundwater basin, groundwater flows inward from the edges of the basin and south parallel to the Sacramento River. Groundwater extraction in some local areas resulted in groundwater depressions and local groundwater gradients (Reclamation and DWR 2003). Before completion of CVP facilities (1964 through 1971), pumping along the west side of the basin caused groundwater levels to decline. In the Sacramento groundwater basin, a slight decline of 2 to 12 feet was experienced in groundwater levels as a result of the 1976 through 1977 and 1987 through 1994 droughts. This was followed by a recovery to predrought conditions of the early 1970s and 1980s. Generally, groundwater level data show an average seasonal fluctuation ranging from 2 to 15 feet. Groundwater production in the basin increased from 500,000 acre-feet in the 1940s to 2 MAF annually in the mid-1990s.

As mentioned, groundwater quality in the Sacramento groundwater basin is generally good and is sufficient for agricultural and M&I uses, with TDS levels ranging from 200 to 500 mg/L (Reclamation and DWR 2003).

CVP/SWP Service Areas

The groundwater basins underlying the CVP/SWP service areas include the San Joaquin Valley, Santa Clara Valley, Antelope Valley, Fremont Valley, Coastal Plain of Los Angeles, and Coastal Plain of Orange County groundwater basins, and multiple other smaller groundwater basins underlying areas that receive water from the CVP/SWP system.

The San Joaquin Valley groundwater basin is a regional basin and is the largest in California, extending approximately from the Delta to Bakersfield. Areas within the San Joaquin Valley groundwater basin are heavily groundwater-reliant. Groundwater accounts for about 30 percent of the annual supply used for agricultural and urban purposes (Reclamation and DWR 2003). Groundwater production in the north San Joaquin Valley groundwater basin alone increased from 1.5 MAF annually in the 1920s to more than 3.5 MAF annually in 1990 (Reclamation and DWR 2003). In the south San Joaquin Valley groundwater basin, groundwater production for agriculture rose from approximately 3.0 MAF per year in the 1920s to more than 5.0 MAF per year 1980s (Reclamation and DWR 2003). Much of the San Joaquin groundwater basin is in overdraft conditions because of extensive groundwater pumping and irrigation, although the extent of overdraft varies widely from region to region.

Groundwater quality throughout the San Joaquin Valley is in general suitable for most urban and agricultural uses. Average TDS concentrations range from 218 to 1,190 mg/L. Areas of high TDS concentration, primarily along the west side of the San Joaquin Valley, are the result of streamflow recharge that originates from marine sediments. High TDS concentrations are also seen in the trough of the Sacramento Valley because of concentration of salts resulting from evaporation and poor drainage (Reclamation and DWR 2003). Agricultural pesticides and herbicides have been detected in groundwater throughout the region, but primarily along the east side of the San Joaquin

Valley, where soil permeability is higher and depth to groundwater is shallower. From 1994 to 2000, 523 public wells out of 689 wells sampled met the State primary maximum contamination levels for drinking water. The remaining wells have constituents that exceed one or more maximum contamination levels (Reclamation and DWR 2003).

6.2 Regulatory Framework

6.2.1 Federal

The following Federal laws, regulations, standards, and plans are discussed as part of the regulatory setting:

- NMFS 2009 Revised Biological Opinion on the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (NMFS 2009)
- USFWS 2008 Revised Biological Opinion on the Coordinated Operations of the CVP and SWP in California (USFWS 2008)
- Central Valley Project Improvement Act (CVPIA) (Reclamation 1999)
- CVP long-term water service contracts
- Trinity River Record of Decision (ROD) (Reclamation 2000)
- Flow objective for navigation (Wilkins Slough)
- Flood management requirements

Regulatory requirements include the 2008 USFWS Biological Opinion (BO), the 2009 NMFS BO and associated Reasonable and Prudent Alternatives (RPA), and the Coordinated Operations Agreement between Reclamation and DWR for the CVP and SWP.

Ongoing reconsultation processes for the 2008 USFWS and 2009 NMFS BOs have resulted in some uncertainty in future CVP and SWP operational constraints. In response to lawsuits challenging the 2008 and 2009 BOs, the District Court for the Eastern District of California (District Court) remanded the BOs to USFWS and NMFS in 2010 and 2011, respectively, and subsequently ordered reconsultation and preparation of new BOs. These legal challenges may result in changes to CVP and SWP operational constraints if the revised USFWS and NMFS BOs contain new or amended RPAs.

Despite this uncertainty, the 2008 and 2009 BOs issued by the fishery agencies contain the most recent estimate of potential changes in water operations that could occur in the near future. Furthermore, it is anticipated that the final BOs issued by the resource agencies will contain similar RPAs. Because the RPAs contained in the 2008 and 2009 BOs have the potential to significantly impact SWP/CVP operations and potential benefits of the SLWRI, they have been implemented in this analysis.

National Marine Fisheries Service 2009 Biological Opinion

In 2009, NMFS issued a Long-Term BO for operation of the CVP and SWP for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2009). The BO includes an RPA that specifies a number of actions, including formation of operation groups, habitat improvements, monitoring requirements and fish passage as well as flow and temperature objectives. This section discusses the actions in the BO that would have directly affect project water operations, mainly flow and temperature objectives. The details on how these were implemented in the modeling and subsequent analysis are included in the Modeling Appendix.

Shasta-Trinity Division

- Clear Creek flow and temperature objectives
- Reclamation deliverable water forecast procedures
- End-of-year (September 30) Shasta target storages
- Shasta cold-water management operations
- Sacramento River temperature objectives between Keswick Dam and Bend Bridge

American River Division

- Lower American River flow objectives
- Lower American River temperature objectives

East Side Division

- “Vamp-like flows” flow objectives
- Stanislaus River flow objectives
- Stanislaus River temperature objectives

Delta Division

- Delta Cross Channel gate operation
- Export limitations when fish are present objectives
- San Joaquin River Inflow to Export Ratio objectives
- San Joaquin River flow at Vernalis objectives

- Old and Middle River (OMR) negative or reverse flow objectives
- Forbid implementation of the South Delta Improvement Program

U.S. Fish and Wildlife Service 2008 Biological Opinion

In 2008, the USFWS issued the BO for operation of the CVP and SWP for delta smelt (USFWS 2008). The BO included a number of habitat improvement and monitoring requirements as well as RPAs that would impact project operations. This section discusses the actions in the BO that would have directly affect project water operations, mainly flow and delta salinity conditions. The details on how these were implemented in the modeling and subsequent analysis are included in the Modeling Appendix.

- Old and Middle River (OMR) flow limits of no more than -1500 to -5000 cfs during periods when delta smelt could be subject to entrainment at the pumps.
- X2 location limits during the fall

Central Valley Project Improvement Act

Reclamation's evolving mission was written into law on October 30, 1992, with the passage by Congress, and signing by President George H. W. Bush, of Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992. Included in the law was Title 34, the CVPIA (Reclamation 1999). The CVPIA amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement having equal priority with power generation. Among the changes mandated by the CVPIA are the following:

- Dedicating 800,000 acre-feet annually to fish, wildlife, and habitat restoration
- Authorizing water transfers outside the CVP service area
- Implementing the Anadromous Fish Restoration Program
- Creating a restoration fund financed by water and power users
- Providing for the Shasta Dam temperature control device (TCD)
- Implementing fish passage measures at RBPP
- Planning to increase the CVP yield
- Mandating firm water supplies for Central Valley wildlife refuges

- Meeting Federal trust responsibility to protect fishery resources on the Trinity River

The CVPIA is being implemented on a broad front. The Final Programmatic Environmental Impact Statement (Reclamation 1999) for the CVPIA analyzes projected conditions in 2022, 30 years from the CVPIA's adoption in 1992. The Final Programmatic Environmental Impact Statement was released in October 1999, and the CVPIA ROD was signed on January 9, 2001.

Operations of the CVP reflect provisions of the CVPIA, particularly Sections 3406 (b)(1), (b)(2), and (b)(3). The U.S. Department of the Interior Decision on Implementation of Section 3406 (b)(2) of the CVPIA, October 5, 1999, provides the basis for implementing upstream and Delta actions with CVP delivery capability. The Vernalis Adaptive Management Program assumes that San Joaquin River water will be acquired under Section 3406 (b)(3) to support increased Vernalis flows during certain times of the year. Similarly, the Anadromous Fish Restoration Program assumes Sacramento River water will be acquired under Section 3406 (b)(2).

Central Valley Project Long-Term Water Service Contracts

In accordance with CVPIA Section 3404c, Reclamation is renegotiating long-term water service contracts. As many as 113 CVP water service contracts in the Central Valley may be renewed during this process. Reclamation issued a Notice of Intent for long-term contract renewal in October 1998. Environmental documentation was prepared on a regional basis. In February 2005, Reclamation issued decisions (a ROD or Finding of No Significant Impact) for renewing contracts of the Sacramento River, San Luis, and Delta-Mendota Canal divisions, the Sacramento River settlement contracts, and several individual contracts. Preparation of environmental documents for other divisions and contracts is ongoing.

Trinity River Record of Decision

Export of Trinity River water to the Sacramento basin provides increased water supply for the CVP and is a major source of CVP power generation. The amounts and timing of the Trinity exports are determined after consideration is given to forecasted Trinity water supply available and Trinity in-basin needs, including carryover storage. Trinity exports also are a key component of water temperature control operations on the upper Sacramento River.

Based on the December 19, 2000, Trinity River Mainstem ROD (Reclamation 2000), 368.6 to 815 TAF are allocated annually for Trinity River flows. After several challenges and injunctions, on July 13, 2004, the Ninth Circuit Court upheld the ROD flows for the Trinity River.

Flow Objective for Navigation (Wilkins Slough)

Historical commerce on the Sacramento River resulted in the requirement to maintain minimum flows of 5,000 cfs at Chico Landing to support navigation.

Currently, no commercial traffic exists between Sacramento and Chico Landing, and USACE has not dredged this reach to preserve channel depths since 1972. However, long-time water users diverting from the river have set their pump intakes just below this level. Therefore, the CVP is operated to meet the navigation flow requirement of 5,000 cfs to Wilkins Slough under all but the most critical water supply conditions to facilitate pumping.

At flows below 5,000 cfs at Wilkins Slough, diverters have reported increased pump cavitation as well as greater pumping head requirements. Diverters operate for extended periods at flows of 4,000 cfs at Wilkins Slough, but pumping operations are severely affected and some pumps become inoperable at flows lower than 4,000 cfs. Flows may drop as low as 3,500 cfs for short periods while changes are made in Keswick releases to reach target levels at Wilkins Slough, but using the 3,500 cfs rate as a target level for an extended period would have major impacts on diverters.

No criteria have been established that specify when the navigation minimum flow should be relaxed. However, the basis for Reclamation's decision to operate at less than 5,000 cfs is the increased importance of conserving water when water supplies are not sufficient to meet full contractual deliveries and other operational requirements.

Flood Management Requirements

Shasta Dam provides flood protection to the nearby communities of Redding, Anderson, Red Bluff, and Tehama, as well as to agricultural lands, industrial developments, and communities downstream along the Sacramento River. Shasta Dam is operated for an objective release of 100,000 cfs at Bend Bridge in Red Bluff, subject to consideration of the following:

- Releases are not to be increased more than 15,000 cfs or decreased more than 4,000 cfs in any 2-hour period.

- The 2,500-square-mile uncontrolled drainage area between Keswick Dam and Bend Bridge can produce flows well in excess of the design channel capacity of 100,000 cfs. These high-magnitude flows can occur very rapidly, requiring release changes based on official flow forecasts, and are complicated by the 8- to 12-hour travel time between Keswick Dam and Bend Bridge.

- Recently installed gages on major east side tributaries (Cow, Battle, and Paynes creeks) between Keswick Dam and Red Bluff are very helpful in coordinating operations of Shasta Dam and Reservoir with flows from uncontrolled downstream areas. The most critical flood forecast for the Sacramento River is that of local runoff entering the Sacramento River between Keswick Dam and Bend Bridge. As the Bend Bridge flow is projected to recede, Keswick Dam releases are increased to evacuate water stored in the flood management space in Shasta Reservoir.

The following constraints are considered when making release changes at Keswick Dam:

- The maximum capacity of Shasta Powerplant is about 18,000 cfs, but this varies considerably with head. Maximum powerplant release is required when Shasta Reservoir storage encroaches on the flood management space by 25 percent or less, with actual or forecasted inflows of 40,000 cfs or less.

- The capacity of Keswick Powerplant is about 16,000 cfs, which represents a maximum release rate when no flood management space is being used. The Keswick Dam release must include discharge from Spring Creek Powerplant, releases from Spring Creek Debris Dam, and local flows into Keswick Reservoir.

- Flows greater than 36,000 cfs begin to cause flood coordination efforts in the local Redding area to close riverfront roads and parks. These coordination efforts require some advance notice to increase Keswick releases above this rate.

All outflows from Shasta Dam flow into and through Keswick Reservoir, located about 5 miles west of Redding. Keswick Reservoir also receives inflow from the 45-square-mile drainage area of Whiskeytown Reservoir on Clear Creek.

Flood Management Space Requirements Shasta Reservoir capacity is 4,552 TAF, with a maximum objective release capacity of 79,000 cfs. The end-of-September storage target for Shasta Reservoir is 1,900 TAF, except in the driest 10 percent of water years, to conserve sufficient cold water for meeting temperature criteria for the winter-run Chinook incubation period (summer to early fall). Storage levels are lowest by October to provide sufficient flood protection and capture capacity during the following wet months. The storage target gradually increases from October to full pool in May. Storage is then withdrawn for high water demand (i.e., municipal, agricultural, fishery, and water quality uses) during summer.

A storage space of up to 1.3 MAF below a full pool elevation of 1,067 feet is also kept available for flood management purposes in the reservoir in accordance with the Shasta Dam and Lake Flood Control Diagram (USACE 1977) , as prescribed by USACE (USACE 1977) (see Exhibit B in the *Hydrology, Hydraulics, and Water Management Technical Report*). Under the diagram, flood management storage space increases from zero on October 1 to 1.3 MAF (elevation 1,018.55) on December 1, and is maintained until December 23. From December 23 to June 15, the required flood management space varies according to parameters based on the accumulation of seasonal inflow. This variable space allows for the storage of water for conservation purposes, unless it is required for flood management based on basin wetness parameters and the level of seasonal inflow. Daily flood management operation consists of determining the required flood storage space reservation, and scheduling releases in accordance with flood operations criteria.

Objective Flow The current regulation of Shasta Dam for flood management requires that releases be restricted to quantities that will not cause downstream flows or stages to exceed, insofar as possible, (1) a flow of 79,000 cfs at the tailwater of Keswick Dam and (2) a stage of 39.2 feet for the Sacramento River at the Bend Bridge gaging station near Red Bluff (corresponding roughly to a flow of 100,000 cfs).

Tributary Inflows Shasta Lake collects flow in the upper Sacramento River watershed, but many uncontrolled tributaries enter the Sacramento River downstream from the dam. Stream gages have been added to major uncontrolled tributaries entering downstream from Shasta Lake (Cow, Battle, Cottonwood, and Thomes creeks). To a limited extent, operators of Shasta Dam can adjust releases containing these uncontrolled flows to try to reduce downstream peak flows. Accordingly, the influence of Shasta Dam and Reservoir operation on reducing peak flood flows diminishes downstream on the Sacramento River.

6.2.2 State

The following State laws, regulations, standards, and plans are discussed as part of the regulatory setting:

- State Water Resources Control Board (SWRCB) Orders 90-05 and 91-01
- 1960 CDFG–Reclamation Memorandum of Agreement (CDFG and Reclamation 1960)
- Water Quality Control Plan (WQCP) for the San Francisco Bay/San Joaquin Delta Estuary (SWRCB 1995)
- SWRCB Revised Water Right Decision 1641 (RD-1641) (SWRCB 2000)
- Coordinated Operations Agreement (COA) (Reclamation and DWR 1986)
- Groundwater regulations

State Water Resources Control Board Orders 90-05 and 91-1

In 1990 and 1991, the SWRCB issued Water Right Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. The orders included a narrative water temperature objective for the Sacramento River, and stated that Reclamation shall operate Keswick and Shasta dams and Spring Creek Powerplant to meet a daily average water temperature of 56°F at RBPP in the Sacramento River during periods when higher temperatures would be harmful to fisheries.

Under the orders, the water temperature compliance point may be modified when the objective cannot be met at RBPP. The Sacramento River Temperature Task Group (SRTTG), a multiagency group, develops temperature operational plans for the Shasta and Trinity divisions of the CVP pursuant to SWRCB Water Rights Orders 90-5 and 91-1. These temperature plans consider the impacts to winter-run Chinook salmon and other races of Chinook salmon from project operations. Previous plans have included releases of water from the low-level outlets at Shasta Dam and Trinity Dam, operation of the TCD, warm-water releases, and manipulating the timing of Trinity River diversions through Spring Creek Powerplant. Warm-water releases from the upper level outlets have been made to conserve cold water in Shasta Lake for temperature control in the late summer and to induce winter-run Chinook salmon to spawn as far upstream as possible. The SRTTG typically first meets in the spring once the cold-water availability in Shasta Lake is known. In almost all years since installation of the TCD on Shasta Dam in 1997, those plans have included modifying the compliance point near the RBPP to make the best use of the cold-water resources based on the location of spawning Chinook salmon (NMFS 2009).

The water right orders also recommended construction of a TCD to improve management of the limited cold-water resources. Reclamation constructed the TCD on Shasta Dam in 1997. This device releases cool water from Shasta Lake through low-level river outlets that bypass the powerplant. The TCD provides flexibility to Shasta Dam operations and allows downstream temperature goals to be consistently achieved (Reclamation 2004).

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet, to the extent possible, the provisions of SWRCB Order 90-05 and 91-01 and the 2009 NMFS BO.

1960 California Department of Fish and Wildlife-Reclamation Memorandum of Agreement

An April 5, 1960, Memorandum of Agreement between CDFW and Reclamation (CDFW and Reclamation 1960) originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. The agreement provided for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critical years. Since October 1981, Keswick Dam has been operated based on a minimum release of 3,250 cfs for normal years from September 1 through the end of February, in accordance with an agreement between CDFW and Reclamation. This release schedule was included in Order 90-05, which maintains a minimum release of 3,250 cfs at Keswick Dam and RBPP from September through the end of February in all water years, except critical years.

Water Quality Control Plan for the San Francisco Bay/San Joaquin Delta Estuary

The 1995 San Francisco Bay/Sacramento-San Joaquin River Delta (Bay-Delta) WQCP (SWRCB 1995) established water quality control objectives for the protection of beneficial uses in the Delta. The 1995 WQCP identified (1) beneficial uses of the Delta to be protected, (2) water quality objectives for the reasonable protection of beneficial uses, and (3) a program of implementation for achieving the water quality objectives. Because these new beneficial objectives and water quality standards were more protective than those of the previous SWRCB Water Right Decision 1485, the new objectives were adopted in 1995 through a water right order for operation of the CVP and SWP. Key features of the 1995 WQCP include estuarine habitat objectives for Suisun Bay and the western Delta (consisting of salinity measurements at several locations), export/inflow (E/I) ratios intended to reduce entrainment of fish at the export pumps, Delta Cross Channel gate closures, and San Joaquin River electrical conductivity (EC) and flow standards. The SWRCB adopted a new Bay-Delta WQCP on December 13, 2006. However, this new WQCP made only minor changes to the 1995 WQCP.

State Water Resources Control Board Revised Water Right Decision 1641

The 1995 Bay-Delta WQCP contains current water quality objectives. SWRCB RD-1641 (SWRCB 2000) and Water Right Order 2001-05 contain the current water right requirements to implement the 1995 WQCP. RD-1641 incorporates water right settlement agreements between Reclamation and DWR and certain water users in the Delta and upstream watersheds regarding contributions of flows to meet water quality objectives. However, the SWRCB imposed terms and conditions on water rights held by Reclamation and DWR that require these two agencies, in some circumstances, to meet many of the water quality objectives established in the 1995 WQCP. RD-1641 also authorizes the CVP and SWP to use joint points of diversion (JPOD) in the south Delta, and recognizes the CALFED Bay-Delta Program (CALFED) Operations Coordination Group process for operational flexibility in applying or relaxing certain protective standards.

Delta Outflow Requirement Delta outflow, inflow that is not exported or diverted, is the primary factor controlling water quality in the Delta. When Delta outflow is low, seawater is able to intrude further into the Delta, impacting water quality at drinking water intakes. RD-1641 specifies minimum monthly Delta outflow objectives to maintain a reasonable range of salinity in the estuarine aquatic habitat based on the Net Delta Outflow Index (NDOI). The NDOI is a measure of the freshwater outflow and is determined from a water balance that considers river inflows, precipitation, agricultural consumptive demand, and project exports. The NDOI does not take into account the semidiurnal and spring-neap tidal cycles.

The monthly minimum values of the NDOI specified in RD-1641 depend on the water year type. Minimum flows are specified for the months of January and July to December. The outflow objectives from February to June are determined based on the X2[2] objective.

Delta Salinity Objectives Salinity standards for the Delta are stated in terms of EC (for protection of agricultural and fish and wildlife beneficial uses), and chloride (for protection of M&I uses). Compliance values vary with water year and month. The salinity objectives at Emmaton on the Sacramento River and at Jersey Point on the San Joaquin River often control Delta outflow requirements during the irrigation season from April through August, requiring additional releases from upstream CVP and SWP reservoirs.

X2 Objective The location of X2, the 2 parts per thousand salinity unit isohaline at 1 meter above the bottom of the Sacramento River channel, is used as a surrogate measure of ecosystem health in the Delta. The X2 objective requires specific daily surface EC criteria to be met for a certain numbers of days each month, from February through June. Compliance can also be achieved by meeting a 14-day running average salinity or 3-day average outflow equivalent. These requirements were designed to provide improved shallow water habitat for fish species in the spring. Because of the relationship between seawater intrusion and interior Delta water quality, the X2 objective also improves water quality at Delta drinking water intakes.

Maximum Export/Inflow Ratio RD-1641 includes a maximum E/I standard to limit the fraction of Delta inflows that are exported. This requirement was developed to protect fish species and to reduce entrainment losses. Delta exports are defined as the combined pumping of water at Banks and Jones pumping plants. Delta inflows are the gaged or estimated river inflows. The maximum E/I ratio is 0.35 for February through June and 0.65 for the remainder of the year. If the January eight-river runoff index is less than 1.0 MAF, the February E/I ratio is increased to 0.45. The CVP and SWP have agreed to share the allowable exports equally if the E/I ratio is limiting exports.

Joint Point of Diversion The JPOD refers to the CVP and SWP use of each other's pumping facilities in the south Delta to export water from the Delta. The CVP and SWP have historically coordinated use of Delta export pumping facilities to assist with deliveries and to aid each other during times of facility failures. In 1978, by agreement with DWR, and with authorization from the SWRCB, the CVP began using the SWP Banks Pumping Plant for replacement pumping (195 TAF per year) for pumping capacity lost at Jones Pumping Plant because of striped bass pumping restrictions in SWRCB Water Right Decision 1485. In 1986, Reclamation and DWR formally agreed that "either party may make use of its facilities available to the other party for pumping and

[2] X2 is the most downstream location of either the maximum daily average or the 14-day running average of 2.64 millimhos per centimeter (mmhos/cm) isohaline, as measured in river kilometers from the Golden Gate Bridge.

conveyance of water by written agreement" and that the SWP would pump CVP water to make up for striped bass protection measures (Reclamation and DWR 1986).

Reclamation filed a number of temporary petitions with the SWRCB to use Banks Pumping Plant for purposes other than replacement pumping and CVP deliveries that contractually relied on SWP conveyance. Such uses included deliveries to Cross Valley Contractors, the Musco Olive Company, and the San Joaquin National Cemetery. In RD-1641, the SWRCB conditionally approved the use of the JPOD in three separate stages:

- Stage 1 is the use of the JPOD to serve Cross Valley Canal contractors, the Musco Olive Company and the San Joaquin National Cemetery; to support a recirculation study; and to recover export reductions made to benefit fish. Authorization for Stage 1 JPOD pumping to recover export reductions prohibits the CVP and SWP from annually exporting more water than each would have exported without the use of each other's pumping facilities. Stage 1 pumping is subject to SWRCB approval of a water level response plan, and a water quality response plan.

- Stage 2 is the use of the JPOD for any purpose authorized in the water rights permits up to the limitations contained in the USACE permit. In addition to the Stage 1 requirements, Stage 2 pumping is subject to SWRCB approval of an operations plan to protect aquatic resources and other legal users of water.

- Stage 3 is the use of the JPOD for any purpose authorized under the water right permits up to the physical capacity of the export pumps. Stage 3 is subject to the operation of barriers or other means to protect water levels in the south Delta, an SWRCB-approved operations plan that adequately protects aquatic resources and other legal users of water, and certification of a project-level Environmental Impact Report by DWR for the South Delta Improvements Program.

The SWRCB has had a policy that all water transfers must meet similar criteria and conditions, as set forth for the JPOD, and the SWRCB has mandated a "response plan" evaluation process for real-time incremental export operations to determine the effects of water transfers and JPOD operations. The SWRCB approval of the 2006 and 2007 Accord Pilot Programs included the provision that rediversion of transfer water at Banks and Jones pumping plants must be in compliance with the various plans under RD-1641 that are prerequisites for the use of the JPOD by Reclamation and DWR.

Reclamation and DWR have produced the following response plans:

- Water Level Response Plan, to address incremental effects of additional export, at the time of the export, to water levels in the south Delta environment (Reclamation and DWR 2004a)
- Water Quality Response Plan, to address incremental effects of additional export, at the time of the export, to water quality in the Delta, and south Delta specifically (Reclamation and DWR 2004b)
- Operations Plan, to protect fish and wildlife, and other legal uses of water

Coordinated Operations Agreement

The COA defines how Reclamation and DWR share their joint responsibility to meet Delta water quality standards and the water demands of senior water right holders, and how the two agencies share surplus flows (Reclamation and DWR 1986). The COA defines the Delta as being in either “balanced water conditions” or “excess water conditions.” Balanced water conditions are periods when Delta inflows are just sufficient to meet water user demands within the Delta, outflow requirements for water quality and flow standards, and export demands. Under excess water conditions, Delta outflow exceeds the flow required to meet the water quality and flow standards. Typically, the Delta is in balanced water conditions from June to November, and in excess water conditions from December through May. However, depending on the volume and timing of winter runoff, excess or balanced water conditions may extend throughout the year.

With the goal of using coordinated management of surplus flows in the Delta to improve Delta export and conveyance capability, the COA received Congressional approval in 1986, and became Public Law 99-546. The COA, as modified by interim agreements, coordinates operations between the CVP and SWP, and provides for the equitable sharing of surplus water supply. The COA requires that the CVP and SWP operate in conjunction to meet State water quality objectives in the Bay-Delta estuary, except as specified. Under this agreement, the CVP and SWP can each contract from the other for the purchase of surplus water supplies, potentially increasing the efficiency of water operations.

Since 1986, the COA principles have been modified to reflect changes in regulatory standards, facilities, and operating conditions. At its inception, the COA water quality standards were those of the 1978 WQCP; these were subsequently modified in the 1991 WQCP. The adoption of the 1995 WQCP by the SWRCB superseded those requirements. The Environmental Water Account was established by CALFED in 2000 to protect the fish of the Bay-Delta estuary via changes in the operations of the CVP and SWP, without incurring uncompensated cost to the projects' water users. Evolution of the Clean Water Act over time has also impacted implementation of the COA.

Groundwater Regulations

Groundwater use is subject to limited statewide regulation; however, all water use in California is subject to constitutional provisions that prohibit waste and unreasonable use of water (SWRCB 1999). In general, groundwater is subject to a number of provisions in the Water Code. Assembly Bill 3030, Water Code Section 10750, commonly referred to as the Groundwater Management Act, permits local agencies to develop groundwater management plans (Reclamation and DWR 2003).

Other groundwater regulation is related primarily to water quality issues, which are addressed by several different State agencies, including the SWRCB and nine Regional Water Quality Control Boards, the California Department of Toxic Substances Control, Department of Pesticide Regulation, and Department of Health Services.

The California Legislature and Governor, as well as private citizens, have become increasingly concerned about recent public well closures regarding the detection of chemicals, such as methyl tertiary-butyl ether from gasoline, and various solvents from industrial sources. As a result of increased awareness of groundwater quality, the Supplemental Report of the 1999 Budget Act required the SWRCB to develop a comprehensive ambient groundwater monitoring plan. To meet this mandate, the SWRCB created the Groundwater Ambient Monitoring and Assessment (GAMA) Program. The primary objective of the GAMA Program is to assess water quality and relative susceptibility of groundwater resources. The GAMA Program has two sampling components: the California Aquifer Susceptibility Assessment for addressing public drinking water wells, and the Voluntary Domestic Well Assessment Project for addressing private drinking water wells.

The GAMA Program is being directed by the SWRCB Division of Water Quality, Land Disposal Section, Groundwater Special Studies Unit. The Voluntary Domestic Well Assessment Project samples domestic wells for various constituents commonly found in domestic well water, and provides that information to domestic well owners. In addition, the Voluntary Domestic Well Assessment Project includes a public education component to aid the public in understanding water quality data and water quality issues affecting domestic water wells. The Voluntary Domestic Well Assessment Project focuses on specific areas, as resources permit. The focus areas are chosen based on existing knowledge of water quality and land use, in coordination with local environmental agencies. The SWRCB incurs the costs of sampling and analysis, and results are provided to domestic well owners as quickly as possible.

6.2.3 Regional and Local

The following local laws, regulations, standards, and plans are discussed as part of the regulatory setting:

- Local surface water regulations (i.e., water supply master plans, general plans, habitat and conservation plans, land use ordinances)
- Local groundwater regulations (i.e., management plans, county ordinances)

Local Surface Water Regulations

Local surface water regulations include goals, objectives, and policies pertaining to the primary and extended study areas, including the following:

- Local water supply master plans
- County general plans
- City general plans
- Local habitat and conservation plans (e.g., Natomas Basin Habitat Conservation Plan)
- Local land-use ordinances

Local Groundwater Regulations

Local regulatory setting documents on groundwater resources in the study areas include local groundwater management plans and county ordinances. Table 6-1 lists current groundwater management plans and county ordinances that apply to agencies in the Redding Area and Sacramento Valley groundwater basins. Groundwater management plans and county ordinances in the San Joaquin Valley groundwater basins are presented in Table 6-2. These documents typically involve provisions to limit or prevent groundwater overdraft, protect groundwater quality, and regulate transfers.

Table 6-1. Groundwater Management Plans and County Ordinances for Redding Area and Sacramento Valley Groundwater Basins

Groundwater Basin	Agency	Plan Name	Year
Redding Area: Subbasins include--Bowman, Rosewood, Anderson, Enterprise, Millville, and South Battle Creek	Shasta County Water Agency for Redding Area Water Council	Coordinated GWMP for the Redding Groundwater Basin	2007
	Anderson-Cottonwood ID	ACID GWMP	2006
	Shasta County	Shasta County Ordinance No. SCC-98-1	
	Tehama County	Tehama County Urgency Ordinance No. 1617	
Sacramento Valley: Subbasins include--Red Bluff, Corning, Colusa, Bend, Antelope, Dye Creek, Los Molinos, Vina, West Butte, East Butte, North Yuba, South Yuba, Sutter, North American, South American, Solano, Yolo, Capay Valley	Tehama County Flood Control and Water Conservation District	Coordinated AB 3030 GWMP-Draft	2012
	Sutter County	Sutter County Groundwater Management Plan	2012
	City of Woodland	Groundwater Management Plan	2011
	City of Vacaville	AB 3030 GWMP	2011
	Sacramento Groundwater Authority	Groundwater Management Plan	2008
	Reclamation District 2035	GWMP	2008
	Dunnigan WD	Dunnigan WD GWMP	2007
	Diablo Water District	GWMP for AB 3030	2007
	Yolo County Flood Control and Water Conservation District	GWMP	2006
	Sacramento County Water Agency	Central Sacramento County GWMP	2006
	City of Davis/University of California, Davis	GWMP	2006
	Reclamation District No. 787	GWMP	2005
	Yuba County Water Agency	Yuba County Water Agency GWMP	2005
	Reclamation District 2068	GWMP	2005

Table 6-1. Groundwater Management Plans and County Ordinances for Redding Area and Sacramento Valley Groundwater Basins (contd.)

Groundwater Basin	Agency	Plan Name	Year
Sacramento Valley: Subbasins include--Red Bluff, Corning, Colusa, Bend, Antelope, Dye Creek, Los Molinos, Vina, West Butte, East Butte, North Yuba, South Yuba, Sutter, North American, South American, Solano, Yolo, Capay Valley (contd.)	Feather Water District	GWMP	2005
	Butte County	Butte County Groundwater Management Plan	2004
	Sacramento County Water Agency	GWMP	2004
	City of Lincoln	City of Lincoln GWMP	2003
	Placer County Water Agency	West Placer GWMP	2003
	Natomas Central Mutual Water Company	GWMP	2002
	Maine Prairie WD	Maine Prairie Water District GWMP	1997
	Reclamation District 1500	GWMP	1997
	Butte WD	Butte WD GWMP	1996
	El Camino ID	El Camino ID GWMP	1995
	Glenn-Colusa ID	Glenn-Colusa ID GWMP AB 3030	1995
	Western Canal WD	GWMP	1995
	Biggs-West Gridley WD	Biggs-West Gridley WD GWMP	1995
	Richvale ID	Richvale ID GWMP	1995
	Thermalito ID	Thermalito ID GWMP	1995
	Sutter Extension Water District	Sutter Extension GWMP	1995
	Sacramento Metropolitan Water Authority	GWMP Initial Phase	1994
	Glenn County	Glenn County Ordinance No. 1115	
	Colusa County	Colusa County Ordinance No. 615	
	Yolo County	Yolo County Export Ordinance No. 615	
	Butte County	Chapter 33 of the Butte County Code	
	Butte County	Well Spacing Ordinance	
	Glenn County	Ordinance No. 1115 and BMOs	
	Yuba County	Transfer Policies	
	Browns Valley Irrigation District	Transfer Policies	
	The Water Forum	Water Forum Agreement	
	Natomas Central Mutual Water Company	Sacramento County Water Agency Act, Sections 32-33	

Key:
AB = Assembly Bill
ACID = Anderson-Cottonwood Irrigation District
BMO = Basin Management Objective
GWMP = Groundwater Management Plan
ID = Irrigation District
SCC = Shasta County Code
WD = Water District

Table 6-2. Groundwater Management Plans and County Ordinances for San Joaquin Valley Groundwater Basins

Groundwater Basin	Agency	Plan Name	Year
San Joaquin Valley: Subbasins include--Eastern San Joaquin, Modesto, Turlock, Merced, Chowchilla, Madera, Delta-Mendota, Tracy, Cosumnes	Turlock GW Basin Association	Turlock GW basin GWMP	2008
	San Joaquin River Exchange Contractors Water Authority	AB 3030-GWMP	2008
	Merced Area Groundwater Pool Interests and Stevinson WD	Merced GW basin GWMP	2008
	San Luis and Delta Mendota Water Authority-North	GWMP for the Northern Agencies in the Delta-Mendota Canal Service Area and a Portion of San Joaquin County	2007
	City of Tracy	Tracy Sub-basin Regional Groundwater Management Plan	2007
	City of Tracy	Tracy Regional GWMP	2007
	Modesto Subbasin	Modesto Subbasin Integrated Regional GWMP	2005
	Eastern San Joaquin Groundwater Banking Authority	Eastern San Joaquin groundwater basin GWMP	2004
	Root Creek WD	GWMP for Root Creek Water District	2003
	Madera County	AB 3030 GWMP	2002
	Southeast Sacramento County Agricultural Water Authority GWMP	Southeast Sacramento County Agricultural Water Authority GWMP	2002
	Calaveras County WD	Camanche Valley Springs AB 3030 GWMP	2001
	Madera ID	AB 3030 GWMP	1999
	Gravelly Ford WD	GWMP for Gravelly Ford ID	1998
	Turlock ID	GWMP	1997
	Chowchilla WD-Red Top Resource Conservation District Joint Powers Authority	GWMP	1997
	Madera WD	GWMP for Madera WD	1997
	Merced ID	Merced ID GWMP	1996
	San Luis and Delta Mendota Water Authority-Southern	GWMP for the Southern Agencies in the Delta-Mendota Canal Service Area	1996
	North San Joaquin WCD	GWMP	1996
	Modesto ID	GWMP for the Modesto ID	1996
	Aliso Water District	GWMP	1996
	Oakdale ID	Oakdale Irrigation District GWMP	1995
	South San Joaquin ID	South San Joaquin Irrigation District GWMP	1995
	Stockton East Water District	Stockton East Water District GWMP	1995
	El Nido ID	El Nido ID GWMP	1995
	Eastside WD	Eastside Water District GWMP	1994
	Merced County	Wellhead Protection Program	
	Delano-Earlimart Irrigation District	GWMP	2007

Table 6-2. Groundwater Management Plans and County Ordinances for San Joaquin Valley Groundwater Basins (contd.)

Groundwater Basin	Agency	Plan Name	Year
San Joaquin Valley: Subbasins include-- Kings, Westside, Pleasant Valley, Kaweah, Tulare Lake, Tule, Kern County	Kaweah Delta Water Conservation District	Kaweah Delta Water Conservation District GWMP	2006
	Deer Creek and Tule River Authority	DCTRA GWMP	2006
	10 agencies in the Fresno Area	Fresno Area Regional GWMP	2006
	Riverdale ID	GWMP for Riverdale Irrigation District	2005
	Kings River Conservation District	Lower Kings Basin GWMP	2005
	Alta ID	GWMP	2004
	Kings County WD	Kings County Water District GWMP	2004
	Pleasant Valley WD	GWMP	2004
	Semitropic Water Storage District	GWMP	2004
	Arvin-Edison Water Storage District	Arvin-Edison Water Storage District GWMP	2003
	James ID	GWMP for James Irrigation District	2001
	County of Fresno	County of Fresno GWMP	1997
	Orange Cove ID	GWMP	1997
	West Kern WD	West Kern WD GWMP	1997
	Fresno ID	GWMP	1996
	Tulare Lake Reclamation District No. 761	GWMP within the Westside Groundwater Basin	1996
	Westlands WD	GWMP	1996
	Kern Delta WD	Kern Delta Water District GWMP	1996
	Consolidated ID	GWMP	1995
	Kings River Conservation District Area "A"	GWMP for the Kings River Conservation District Area "A"	1995
	Kings River Conservation District Area "B"	GWMP for the Kings River Conservation District Area "B"	1995
	Kings River Conservation District Area "C"	GWMP for the Kings River Conservation District Area "C"	1995
	Lower Tule River ID	Deer Creek and Tule River Authority GWMP	1995
	Rosamond Community Services District	GWMP	1995
	Tulare Lake Bed	Tulare Lake Bed Coordinated GWMP	1994
	North Kern Water Storage District	North Kern Water Storage District GWM Program	1993
	Shafter-Wasco ID	GWM Program	1993
	Fox Canyon Groundwater Management Authority	Groundwater Management Plan for the Fox Canyon Groundwater Management Agency	1985

Key:
AB =Assembly Bill
GW = Groundwater
GWM = Groundwater Management
GWMP = Groundwater Management Plan
ID = Irrigation District
WCD = Water Conservation District
WD = Water District

6.3 Environmental Consequences and Mitigation Measures

The purpose of this section is to provide information about the environmental consequences of the SLWRI study alternatives on hydraulics and hydrology, including water management, and potential impacts on existing facilities. This section describes the methods and assumptions, criteria for determining significant impacts, and impacts and mitigation measures associated with the H&H effects of each of the SWLRI alternatives. Implementation of the action alternatives considered in the study would affect the H&H of the Sacramento River, Feather River, American River, and the CVP/SWP systems. Impacts on the H&H of the CVP/SWP systems would translate to potential impacts on related surface and groundwater supplies available for CVP/SWP water users.

6.3.1 Methods and Assumptions

A suite of modeling tools was used to evaluate the potential impacts of the No-Action Alternative and various SLWRI action alternatives on the H&H of the project, and to quantify potential benefits. The CalSim-II model, SLWRI 2012 Benchmark Version, was used to simulate CVP and SWP operations, determining the surface water flows, storages, and deliveries associated with each alternative. CalSim-II is a specific application of the Water Resources Integrated Modeling System (WRIMS) to simulate CVP and SWP water operations. A detailed description of the SLWRI 2012 Benchmark Version CalSim-II model, including modeling assumptions, is included in Chapter 2 of the Modeling Appendix. Delta Simulation Model 2 (DSM2), Version 8.0.6, was used to simulate Delta hydrodynamics, providing the data used to discuss the water-level-related impacts of each alternative. A detailed description of DSM2 and the assumptions used in the SLWRI analysis are included in Chapter 7 of the Modeling Appendix. Analysis and modeling results are summarized below; more detailed results of the CalSim-II output can be found in Attachment 1 of the Modeling Appendix. Attachment 16 of the Modeling Appendix contains detailed results of the DSM2 modeling.

CalSim-II

CalSim-II is the application of the Water Resources Integrated Modeling System software to the CVP/SWP. This application was jointly developed by Reclamation and DWR for planning studies relating to CVP/SWP operations. The primary purpose of CalSim-II is to evaluate the water supply reliability of the CVP and SWP at current and/or future levels of development (e.g., 2005, 2030), with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the drainage basin of the Delta, and CVP/SWP exports to the San Francisco Bay Area, San Joaquin Valley, Central Coast, and Southern California.

CalSim-II typically simulates system operations for an 82-year period using a monthly time step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed level of development (e.g., 2005, 2030). The historical flow record of October 1921 to September 2003, adjusted for the influences of land use changes and upstream flow regulation, is used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CalSim-II uses a mass balance approach to route water through this network. Simulated flows are mean flows for the month; reservoir storage volumes correspond to end-of-month storage.

CalSim-II models a complex and extensive set of regulatory standards and operations criteria. Descriptions of both are contained in Chapter 2 of the Modeling Appendix. The hydrologic analysis conducted for this DEIS used SLWRI 2012 Benchmark Version CalSim-II models, which are the best available hydrological modeling tools, to approximate system-wide changes in storage, flow, salinity, and reservoir system reoperation associated with the SLWRI alternatives. Although CalSim-II is the best available tool for simulating system-wide operations, the model also contains simplifying assumptions in its representation of the real system. CalSim-II's predictive capability is limited and cannot be readily applied to analyzing flood flows and hourly, daily, or weekly time steps for hydrologic conditions. The model, however, is useful for comparing the relative effects of alternative facilities and operations within the CVP/SWP system.

A general external review of the methodology, software, and applications of CalSim-II was conducted in 2003 (Close et al. 2003). Recently, an external review of the San Joaquin River Valley CalSim-II model also was conducted (Ford et al. 2006). Several limitations of the CalSim-II models were identified in these external reviews. The main limitations of the CalSim-II models are as follows:

- Model uses a monthly time step
- Accuracy of the inflow hydrology is uncertain
- Model lacks a fully explicit groundwater representation

In addition, Reclamation, DWR, and external reviewers have identified the need for a comprehensive error and uncertainty analysis for various aspects of the CalSim-II model. DWR has issued the CalSim-II Model Sensitivity Analysis Study (DWR 2005) and Reclamation has recently completed a similar sensitivity and uncertainty analysis for the San Joaquin River basin (Reclamation and DWR 2006a). This information will improve understanding of model results.

Despite these limitations, monthly CalSim-II model results remain useful for comparative purposes. It is important to differentiate between "absolute" or "predictive" modeling applications and "comparative" applications. In "absolute" applications, the model is run once to predict a future outcome;

errors or assumptions in formulation, system representation, data, operational criteria, etc., all contribute to total error or uncertainty in model results. In "comparative" applications, the model is run twice, once to represent a base condition (no-action) and a second time with a specific change (action) to assess the change in the outcome because of the input change. In the comparative mode (the mode used for this DEIS), the difference between the two simulations is of principal importance. Most potential errors or uncertainties affecting the "no-action" simulation also affect the "action" simulation in a similar manner; as a result, the effect of errors and uncertainties on the difference between the simulations is reduced. However, not all limitations are fully eliminated by the comparative analysis approach; small differences between the alternatives and the bases of comparison are not considered to be indicative of an effect of the alternative.

DSM2

DSM2 is a branched 1-dimensional model used to simulate hydrodynamics, water quality, and particle tracking in a network of riverine or estuarine channels. The hydrodynamic module can simulate channel stage, flow, and water velocity. The water quality module can simulate the movement of both conservative and nonconservative constituents. DWR uses the model to perform operational and planning studies of the Delta.

DSM2 analysis is typically performed for the period 1922 to 2003. In model simulations, EC is typically used as a surrogate for salinity. Results from CalSim-II are used to define Delta boundary inflows. CalSim-II-derived boundary inflows include the Sacramento River flow at Hood, the San Joaquin River flow at Vernalis, inflow from the Yolo Bypass, and inflow from the eastside streams. In addition, Net Delta Outflow from CalSim-II is used to calculate the salinity boundary at Martinez.

Details of the model, including source codes and model performance, are available online at the DWR Bay-Delta Office's Modeling Support Branch Web site. Documentation on model development is discussed in annual reports to the SWRCB, such as Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh, prepared by the Delta Modeling Section of DWR (DWR 2009).

6.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A significant effect on the environment means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The significance criteria were developed based on the guidance provided by the State CEQA Guidelines, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on hydraulics, hydrology, and water management would be significant if project implementation would cause the results in the second column of Table 6-3 to occur. Simulated stream flow and reservoir storage data, generated as part of the hydrology, hydraulics and water management impact assessment, were used in the impact assessments for groundwater, hydropower, flood control, water quality, fisheries, terrestrial biology, recreation, and cultural resources. Accordingly, a detailed description of changes in flow and storage expected to result from each of the SLWRI alternatives is included, in addition to the impact analysis.

Table 6-3. Impact Indicators and Significance Criteria for Water Management

Impact Indicator	Significance Criterion
Flood Management	Increase frequency or severity of damaging flood flows, as indicated by the following: • Increase frequency of daily flows above 100,000 cfs on the Sacramento River below Bend Bridge • Place housing or other structures within a 100-year flood hazard area as mapped on a Federal flood hazard boundary or Flood Insurance Rate Map or other flood hazard delineation map • Place within a 100-year flood hazard area structures that would impede or redirect flood flows
Water Supply Reliability	Reduce water supply reliability to the following CVP/SWP contractors: • North-of-Delta CVP Water Service Contractors or Refuges • South-of-Delta CVP Water Service Contractors or Refuges • SWP Table A Contractors
Water Levels in the South Delta[1]	Reduce water surface elevation, relative to the basis of comparison, with sufficient frequency and magnitude to adversely affect south Delta water users' abilities to divert water during the irrigation season.
X2 Location	Increase in X2 that adversely affects CCWD's ability to fill Los Vaqueros Reservoir: • Movement of X2 location to west of Chipps Island from February through May • Movement of X2 location to west of Collinsville during December, January, and June
Delta Excess Water Conditions	Reduction in the duration of Delta excess conditions during the November-to-June period that adversely affects CCWD's ability to fill Los Vaqueros Reservoir.
Groundwater Resources	A change in groundwater level or quality that would adversely affect users, as indicated by the following: • A change in groundwater level resulting in long-term overdraft conditions for the groundwater basins • A change groundwater quality resulting in substantially adverse effects to designated beneficial uses of groundwater.

Note:
[1] Changes in south Delta water levels are estimated using the DSM2 Model.

Key
CCWD = Contra Costa Water District
cfs = cubic feet per second
Delta = Sacramento-San Joaquin Delta

Significance statements are relative to both existing conditions (2005) and future conditions (2030) unless stated otherwise.

Flood Management

To prevent an increase in flood damages in the study area, the SLWRI must not cause a significant increase in the frequency or magnitude of flood flows on the Sacramento River. The current regulation of Shasta Dam for flood control requires that releases be restricted to quantities that will not cause downstream flows or stages to exceed, insofar as possible, (1) a flow of 79,000 cfs at the tailwater of Keswick Dam, and (2) a stage of 39.2 feet at the Sacramento River Bend Bridge gaging station near Red Bluff (corresponding roughly to a flow of 100,000 cfs). Because of the uncontrolled nature of the inflows between Keswick Dam and Bend Bridge, the 100,000 cfs flow objective at Bend Bridge is the critical objective for minimizing flood damage. It is also important to ensure that the project does not increase potential flood damages by locating any new facilities within the 100-year floodplain or in a location that could impede or redirect flood flows, thereby potentially increasing damage to other property.

Water Supply Reliability

The CVP provides water to a range of contract types; Settlement and Exchange contractors have the highest degree of reliability because of water rights senior to the CVP. Because of their high priority, these contractors are not strongly affected by any of the SLWRI alternatives. Water service contractors and refuges are subject to shortages according to water availability and their geographic location; because of conveyance constraints, south-of-Delta water service contractors and refuges have a lower degree of reliability than north-of-Delta water service contractors and refuges. Although the SWP has several contractors north of the Delta, the vast majority of recipients of SWP water supplies are south of the Delta. SWP contractors have several types of water in their contract; the Table A contracts (DWR 2003a) are most susceptible to variability of supply.

To prevent a decrease in water supply, the SLWRI must not cause a significant reduction in long term water supply reliability to CVP and SWP contractors. For this analysis a significant reduction in long term reliability is defined as a 5 percent or greater reduction in average annual or average dry and critical year reliability. This is assumed to represent a reduction that could not reliably be replaced from other sources, such as groundwater pumping or water transfers.

Some flexibility would exist to adjust for changes in surface water supply from month to month, for example temporarily increased ground water pumping, but long term changes in monthly supply could have a significant impact. For this analysis a significant reduction in monthly reliability is defined as a greater than 10 percent reduction in average monthly water supply. This is assumed to represent a reduction that could not reliably be replaced from other sources, such as groundwater pumping or water transfers.

South Delta Water Levels

Water levels in the south Delta are influenced to varying degrees by natural tidal fluctuations, San Joaquin River flows, barrier operations, CVP and SWP export pumping, local agricultural diversions and drainage return flows, channel capacities, siltation, and dredging. When the CVP and SWP are exporting water, water levels in local channels can be drawn down, particularly during low water years. The South Delta Water Agency and local farmers in the south and central Delta have interests in maintaining the water levels so that their siphons and pumps, which are installed at fixed locations in the Delta, can continue to be used for irrigation diversions. The SLWRI alternatives could affect the ability of the South Delta Water Agency to divert water if changes in Delta operations reduce Delta channel water levels during the irrigation season, from April to October.

The South Delta Temporary Barriers Program was initiated by DWR in 1991 to improve water conditions in the south Delta and to provide design data for permanent gates. Since 1991, DWR has seasonally installed four barriers. Three barriers, located on the Middle River, Grant Line Canal, and Old River, ensure adequate water levels and water quality for agricultural diversions. The barriers are constructed from rock fill and incorporate overflow weirs and gated culverts. These barriers are installed in spring and removed in fall. A fourth barrier is seasonally installed at the Head of the Old River for fish control. The existing seasonal barriers significantly affect water levels in the south Delta.

To determine the potential for changes in Delta CVP/SWP operations to occur as an indirect effect of Interim and Restoration flows from the San Joaquin River reaching the Delta, analyses in the DEIS compared water surface elevations simulated using DSM2 to the criteria identified in the Water Level Response Plan. The criteria identified in the plan also are applied in the DEIS, such that a change in water level is considered potentially significant if the following conditions are both true:

1. The simulated water level is below 0.0 feet at msl at the Old River near Tracy Boulevard Bridge and at locations above the Grant Line Canal Barrier, or 0.3 foot above msl at the Middle River near the Howard Road Bridge. A simulated water level below these thresholds would indicate a time period when Reclamation and DWR would adjust real-time operations at Jones and Banks pumping plants to maintain consistency with the provisions of the Water Level Response Plan. Typically this would include reducing diversions at Jones and Banks pumping plants.

2. The simulated water level change between the alternative and baseline is greater than a 0.1-foot decrease during the irrigation season of April through October when the simulated water levels under the baseline conditions are below the threshold values for the three locations described above. A threshold of change of 0.1-foot was selected

because it is consistent with the level of precision provided in the water level response plan standards, and it provides a conservative threshold to identify the likelihood that real-time adjustments to CVP/SWP operations would result in water recapture from the Delta that would differ from simulated operations.

X2 Location

CCWD depends almost entirely on the Delta for water supply. CCWD's raw water system consists of four Delta pumping plants (i.e., Mallard Slough, Rock Slough, Old River, and Victoria Canal), and a 160-TAF reservoir (Los Vaqueros). The intakes on Rock Slough, Old River, and Victoria Canal are the primary source for CCWD. The fourth intake at Mallard Slough is used only when water quality conditions in the western Delta permit, usually following a prolonged period of surplus Delta outflow. Water diverted at the Old River and Victoria Canal intakes is either used directly or stored in Los Vaqueros Reservoir for later use. CCWD's current operational priority is to fill Los Vaqueros Reservoir with high quality water whenever possible.

CCWD diversions to fill Los Vaqueros Reservoir are constrained by the USFWS delta Smelt BOs on operations of Los Vaqueros Reservoir (USFWS 1993 and 2011), as modified by agreements among CCWD, USFWS, CDFW, and the SWRCB. From February through May, the BO precondition for filling the reservoir is that the X2 location is west of Chipps Island. In December, January, and June, the X2 location must be west of Collinsville. Filling Los Vaqueros Reservoir is unconstrained in December if no delta smelt are present at the diversion location.

For the impact analysis, it is assumed that from February to June, the X2 requirement for filling Los Vaqueros Reservoir will be met by Reclamation and DWR as part of their responsibilities under RD-1641.[3] Changes in simulated Delta conditions are considered to be potentially significant only for the months of December and January, and only when all of the following conditions are met:

- The Delta is not in balanced condition[4]
- Under the basis of comparison, X2 is west of Collinsville
- Under the SLWRI alternatives, X2 is east of Collinsville

[3] When the Eight River Index is less than 8.1 MAF, the RD-1641 X2 requirements for May and June are relaxed, potentially impacting filling of Los Vaqueros Reservoir. Model simulations show that this would occur eight times during the simulated or historical record for water years 1922 to 1994, but in these circumstances the Delta would be in balanced water conditions.

[4] Balanced water conditions are periods when it is agreed by Reclamation and DWR that releases from upstream reservoirs plus unregulated flows approximately equal the water supply needed to meet Sacramento Valley in-basin uses plus required Delta outflows and exports (Reclamation and DWR 1986).

Reclamation and DWR are not authorized to use the JPOD when the Delta is in excess conditions, and when such diversions would cause the location of X2 to shift upstream and prevent CCWD from filling Los Vaqueros Reservoir under its water right permits.

Delta Excess Water Conditions

Changes from Delta excess water conditions to balanced conditions could adversely affect CCWD's ability to fill Los Vaqueros Reservoir. Under SWRCB Water Right Decision 1629, filling Los Vaqueros Reservoir is restricted to the parts of the period from November 1 to June 30 when the Delta is in excess water conditions. Changes in simulated Delta conditions are considered to be potentially significant if during this period the following conditions are met:

- Under the basis of comparison, the Delta is in excess conditions
- Under the SLWRI alternatives, the Delta is in balanced conditions

Groundwater Resources

Impacts on groundwater resources would be considered significant if actions related to the SLWRI alternatives would cause the groundwater resources impacts described in Table 6-3. Improvements in water supply reliability under the SLWRI alternatives may affect groundwater levels, budget, and quality in the primary and extended study areas. In general, potential impacts of the SLWRI in the primary and extended study areas would result from a reduction in water extraction because of increased surface water supply reliability. Currently, CVP and SWP water users in the primary and extended study areas pump groundwater to supplement surface water supply.

Potential impacts on groundwater resources, particularly groundwater levels, budget, and water quality, are evaluated qualitatively based on changes in surface water supply. This approach is based on the assumption that the actual reduction in groundwater extraction would be proportional to the increase in surface water supply reliability that would occur in the study areas under the SLWRI alternatives. According to the 2009 update to the California Water Plan (DWR 2009) water plan ground water pumping is approximately 2.6, 2.7, and 5.5 million acre-feet per year in the Sacramento (CVP north of Delta area), San Joaquin (CVP south of Delta), and Tulare Lake (SWP Ag south of Delta, or about half of total SPW south of Delta delivery) basins respectively. Changes in groundwater pumping in the study areas would be relatively small compared to the estimated millions of acre-feet of annual groundwater pumping. Nevertheless, the SLWRI alternatives would have a positive, albeit limited, impact by reducing reliance on groundwater in the study areas. Because effects on groundwater basins would be limited and positive, groundwater impacts are discussed qualitatively.

6.3.3 Direct and Indirect Effects

This section describes the environmental consequences of the SLWRI alternatives, and proposed mitigation measures for any impacts determined to be significant or potentially significant. All alternatives are compared to a basis of comparison. For the existing condition (2005 level of development), a CalSim-II simulation for the existing condition is used. Similarly, the future condition (2030 level of development) uses a CalSim-II simulation of the No-Action/No-Project Alternative as a basis of comparison. Each of the alternatives is simulated using the same level of development so that any changes from the basis of comparison in H&H can be attributed to the alternative.

Alternatives Description

The six SLWRI alternatives are described in the following subsections.

No-Action Alternative Under the No-Action Alternative, the Federal government would take reasonably foreseeable actions, including actions with current authorization, secured funding for design and construction, and environmental permitting and compliance activities that are substantially complete. However, the Federal Government would not take additional actions toward implementing a plan to raise Shasta Dam to help increase anadromous fish survival in the upper Sacramento River, nor help address the growing water reliability issues in California. Shasta Dam would not be modified, and the CVP would continue operating similar to the existing condition. Changes in regulatory conditions and water supply demands would result in differences in flows on the Sacramento River and at the Delta between existing and future conditions. Possible changes include the following:

- Firm Level 2 Federal refuge deliveries
- SWP deliveries based on full Table A amounts
- Full implementation of the Grassland Bypass Project
- Implementation of San Joaquin River flow requirements similar to the Vernalis Adaptive Management Plan
- Implementation of the South Bay Aqueduct Improvement and Enlargement Project
- Increased San Joaquin River diversions for water users in the Stockton Metropolitan Area after completion of the Delta Water Supply Project
- Increased Sacramento River diversions by Freeport Regional Water Project agencies
- San Joaquin River Restoration Program Full Restoration Flows

This alternative is used as a basis of comparison for future condition comparisons.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 focuses on increasing water supply reliability and increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 6.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 8.5 feet and enlarge the total storage capacity in the reservoir by 256,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 70 TAF and 35 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP1 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

As with CP1, CP2 focuses on increasing water supply reliability and increasing anadromous fish survival. CP2 primarily consists of raising Shasta Dam by 12.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 14.5 feet and enlarge the total storage capacity in the reservoir by 443,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 120 TAF and 60 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP2 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

CP3 focuses on increasing agricultural water supply reliability while also increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 18.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Because CP3 focuses on increasing agricultural water supply reliability, none of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, with the additional storage retained for water supply reliability and to expand the cold-water pool for downstream anadromous fisheries.

Simulations of CP3 did not involve any changes to the modeling logic for deliveries or flow requirements; all rules for water operations were updated to include the new storage, but were not otherwise changed.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

CP4 focuses on increasing anadromous fish survival while also increasing water supply reliability. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP4 would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. The additional storage created by the 18.5-foot dam raise would be used to improve the ability to meet temperature objectives and habitat requirements for anadromous fish during drought years and increase water supply reliability. Of the increased reservoir storage space, about 378,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. Operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as in CP1, with 70 TAF and 35 TAF reserved specifically to focus on increasing M&I deliveries during dry and critical years, respectively. CP4 also includes augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River.

CP5 – 18.5-Foot Dam Raise, Combination Plan

CP5 primarily focuses on increasing water supply reliability, anadromous fish survival, Shasta Lake area environmental resources, and recreation opportunities. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP5 would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 150 TAF and 75 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP5 also includes constructing additional fish habitat in and along the shoreline of Shasta Lake and along the lower reaches of its tributaries; augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River; and increasing recreation opportunities at Shasta Lake.

CP5 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Changes to CVP/SWP Operations

Each of the SWLRI alternatives would have similar impacts on CVP and SWP operations compared to either the existing condition or the No-Action Alternative. However, the magnitude of the impacts would vary according to the alternative. Detailed tables of the estimated monthly flows and storages associated with each alternative, in addition to changes from the bases of comparison, are included in Attachment 1 of the Modeling Appendix. Results are summarized below.

The analysis assumed that the SLWRI alternatives would not alter existing operational rules or protocols; no formal changes to CVP or SWP operating criteria are associated with the SLWRI. At a base level, each action alternative would store some additional flows behind Shasta Dam during periods when the flows would have otherwise been released downstream. The resulting increase in storage would then be used to both create an expanded cold-water pool, thus benefiting fisheries, and for subsequent release downstream when there are opportunities to put the water to beneficial use.

Reductions in Shasta releases under the various SLWRI alternatives would typically occur during winter (November through March) in relatively wet years, and increases in releases would typically occur in the late spring and summer (June through September) of drier years. Shasta Dam typically makes releases for one of six purposes:

- Flood management
- Sacramento River flow requirements both below Keswick and at Wilkins Slough
- Sacramento River water temperature requirements at Bend Bridge
- Delta water quality requirements
- Senior water rights along the Sacramento River
- CVP water supply contracts needs both north and south of the Delta

However, release for one purpose may also be sufficient for meeting another; for instance, releases for Sacramento River water temperatures may also be used to both meet Delta water quality requirements and for export to south-of-Delta contractors. Although releases for flood management purposes typically occur in winter, water temperature and water quality requirements exist year-around. Releases for water supply purposes primarily occur in late spring, summer, and early fall.

Table 6-4 summarizes monthly flows and changes below Shasta Dam. Releases from Shasta Dam would typically be increased in the summer months, corresponding with the periods of greatest agricultural demands. Similarly, releases would be reduced in the winter months, when the increased storage would be used to capture additional runoff rather than releasing to the downstream river.

Table 6-4. Simulated Monthly Average Sacramento River Flows Below Shasta Dam

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 (cfs)	CP2 (cfs)	CP4 (cfs)	CP3 and CP5 (cfs)		CP1 (cfs)	CP2 (cfs)	CP4 (cfs)	CP3 and CP5 (cfs)
October	5,023	90 (2%)	209 (4%)	196 (4%)	196 (4%)	4,998	100 (2%)	147 (3%)	139 (3%)	162 (3%)
November	6,056	101 (2%)	171 (3%)	154 (3%)	161 (3%)	5,895	105 (2%)	183 (3%)	234 (4%)	207 (4%)
December	6,321	-314 (-5%)	-392 (-6%)	-556 (-9%)	-596 (-9%)	6,182	-291 (-5%)	-470 (-8%)	-661 (-11%)	-628 (-10%)
January	7,244	-106 (-1%)	-244 (-3%)	-276 (-4%)	-303 (-4%)	7,218	-197 (-3%)	-265 (-4%)	-354 (-5%)	-335 (-5%)
February	9,408	-200 (-2%)	-287 (-3%)	-304 (-3%)	-386 (-4%)	9,463	-244 (-3%)	-366 (-4%)	-384 (-4%)	-485 (-5%)
March	7,704	-59 (-1%)	-138 (-2%)	-189 (-2%)	-191 (-2%)	7,710	-59 (-1%)	-137 (-2%)	-214 (-3%)	-200 (-3%)
April	6,541	79 (1%)	93 (1%)	139 (2%)	135 (2%)	6,427	125 (2%)	154 (2%)	205 (3%)	180 (3%)
May	7,682	-36 (0%)	-60 (-1%)	-22 (0%)	-32 (0%)	7,653	-22 (0%)	-34 (0%)	32 (0%)	3 (0%)
June	10,223	-7 (0%)	37 (0%)	47 (0%)	74 (1%)	10,311	80 (1%)	115 (1%)	75 (1%)	127 (1%)
July	11,316	131 (1%)	175 (2%)	186 (2%)	266 (2%)	11,431	14 (0%)	116 (1%)	114 (1%)	196 (2%)
August	8,488	51 (1%)	28 (0%)	141 (2%)	75 (1%)	8,494	120 (1%)	148 (2%)	282 (3%)	188 (2%)
September	6,107	136 (2%)	172 (3%)	165 (3%)	288 (5%)	6,334	146 (2%)	206 (3%)	243 (4%)	290 (5%)
Total (TAF)	5,550	-8 (0%)	-14 (0%)	-19 (0%)	-18 (0%)	5,550	-7 (0%)	-12 (0%)	-17 (0%)	-17 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C4)

Note:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Storage in Shasta Reservoir fluctuates greatly throughout a year; storage is typically highest at the end of winter, March and April, as the need for flood control reservation space in the reservoir is reduced. Storage is typically at its lowest in October and November, after the irrigation season and before the winter refill begins. As a result of the increased storage capacity attributed to each alternative, and the flow reductions described above, Shasta Reservoir storage would be generally higher under the SLWRI alternatives than under the existing condition or the No-Action Alternative (future condition). This additional storage would typically be greatest in the winter (March and April), and would be lowest at the end of summer (October or November), as shown in Table 6-5. Additional runoff captured by the increased storage increment would typically remain in storage until it could be used to meet one of the purposes described above. Conversely, under either of the bases of comparison, if water in storage were insufficient to meet all of the project purposes, the first increment to be reduced would be deliveries to water service contractors. Therefore, increased releases would typically be made on a schedule providing increased reliability of deliveries to water service contractors, typically in July through October of relatively dry years.

Table 6-5. Simulated Average End-of-Month Shasta Reservoir Storage

Month	Existing Condition (2005)						Future Condition (2030)					
	Existing Condition (TAF)	Change from Base					No-Action Alt (TAF)	Change from Base				
		CP1 (TAF)	CP2 (TAF)	CP3 (TAF)	CP4 (TAF)	CP5 (TAF)		CP1 (TAF)	CP2 (TAF)	CP3 (TAF)	CP4 (TAF)	CP5 (TAF)
October	2,592	148	282	399	526	383	2,587	141	245	366	519	351
November	2,568	142	271	390	520	373	2,573	134	234	351	512	338
December	2,722	161	295	424	539	409	2,735	152	263	392	530	377
January	2,995	167	310	440	545	428	3,010	164	279	413	542	397
February	3,267	178	326	457	556	449	3,279	178	299	435	556	424
March	3,625	182	334	468	560	460	3,636	181	307	447	559	436
April	3,916	177	328	459	555	451	3,934	173	298	434	551	424
May	3,941	179	330	459	557	452	3,961	174	299	431	552	423
June	3,639	178	327	455	556	447	3,653	169	291	426	547	414
July	3,160	170	315	442	548	428	3,167	167	283	417	545	401
August	2,834	166	312	431	544	422	2,841	159	273	398	537	387
September	2,669	157	301	420	535	404	2,662	150	260	382	528	369

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)

Notes:
Simulation period: 1922-2003
Key:
Alt = alternative
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

A key indicator of water temperature benefits of the SLWRI alternatives to the Sacramento River between Keswick Dam and Red Bluff is the amount of cold water available in Shasta Reservoir before the water temperature operation season, about May through October. As previously described, Shasta Reservoir generally reaches its maximum storage during late April or early May. Also, the cold-water pool volume in the lake accumulates during the winter and early spring and is not likely to increase after April. Therefore, the expected increase in spring storage for each dam raise alternative should also result in an incremental increase in the cold-water pool volume.

Reclamation operates the Shasta Dam TCD to manage water temperatures in the Sacramento River to: (1) improve habitat for the endangered winter-run Chinook salmon and other threatened runs, (2) withdraw warmer surface water in the winter and spring to preserve cold-water storage for release during the temperature operation season, and (3) enable power generation to continue while controlling release temperatures, which eliminates the need to bypass the powerplant penstocks via the low-level river outlets. Generally, to accomplish these temperature objectives during the temperature operation season, the TCD functions to select water temperatures in the 47 degrees Fahrenheit (°F) to 52°F range. Therefore, a good index of the temperature-related benefits of the alternative is the volume of the cold-water pool less than 52°F at the end of April. In the context of historical project operation, reservoir storage and cold-water pool conditions in mid-spring represent the available cold-water “bank” managed throughout the temperature operation season (July through October), as prescribed by the SRTTG. The simulated end-of-April volume of water less than 52°F for the two bases of comparison, and the change in cold-water pool volume for each of the SLWRI alternatives, are shown by Sacramento Valley Index in Table 6-6. As expected, the higher dam raise alternatives generally reflect a larger cold-water pool volume.

Table 6-6. Simulated Average Volume of Water Less than 52˚F in Shasta Reservoir at the End of April

Year Type[1]	Existing Condition (2005)						Future Condition (2030)					
	Existing Condition (TAF)	Change from Base					No-Action Alt (TAF)	Change from Base				
		CP1 (TAF)	CP2 (TAF)	CP3 (TAF)	CP4 (TAF)	CP5 (TAF)		CP1 (TAF)	CP2 (TAF)	CP3 (TAF)	CP4 (TAF)	CP5 (TAF)
Average of All Years	2,609	142	267	385	470	378	2,628	137	241	357	457	349
Wet	2,804	186	331	500	510	500	2,799	189	339	498	506	498
Above Normal	2,972	163	296	432	502	439	2,979	161	289	430	489	423
Below Normal	2,699	129	263	382	462	357	2,736	130	225	337	463	339
Dry	2,542	130	231	322	441	317	2,562	100	181	261	398	266
Critical	1,601	49	134	151	364	142	1,659	50	70	117	365	59

Source: Benchmark Study Team April 2010 Version SRWQM 2005 and 2030 simulations

Notes:

[1] Water year types as defined by the Sacramento Valley Index

[2] Simulation period: 1922-2003

Key:

ºF = degrees Fahrenheit

Alt =alternative

CP = comprehensive plan

TAF = thousand acre-feet

Downstream from Shasta Dam, the Sacramento River combines with releases from Trinity Reservoir through Whiskeytown Reservoir and Spring Creek Tunnel above Keswick Dam. Because of the connected nature of Shasta Reservoir and Trinity Reservoir for meeting instream flow requirements and water supply demands below Keswick Dam, changes in Shasta Reservoir operations would possibly result in changes to operations of Trinity Reservoir. Table 6-7 shows changes in Trinity Reservoir storage that would result from SLWRI alternatives. These changes are small relative to the reservoir storage and should not result in noticeable changes at Trinity Reservoir. To limit the effect of the enlarged Shasta Reservoir on Trinity Reservoir operations, the relationship in CalSim-II between Shasta Reservoir storage and Trinity Reservoir exports to the Sacramento River was modified through interpolation to approximately maintain the export level of the basis of comparison in the action alternatives.

Table 6-7. Simulated Average End-of-Month Trinity Lake Storage

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (TAF)	Change from Base				No-Action Alt (TAF)	Change from Base			
		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)
Oct	1,323	17	19	32	20	1,328	15	6	17	5
Nov	1,331	18	21	35	23	1,353	16	8	19	7
Dec	1,382	17	19	33	22	1,404	16	7	18	6
Jan	1,444	18	22	38	26	1,467	17	11	23	11
Feb	1,553	17	21	36	24	1,575	15	9	21	10
Mar	1,676	15	18	32	20	1,695	12	7	15	5
Apr	1,826	19	23	35	25	1,849	18	13	22	12
May	1,820	19	23	35	24	1,843	17	12	21	12
Jun	1,783	19	22	33	23	1,807	18	12	19	11
Jul	1,646	18	20	33	23	1,669	14	9	17	9
Aug	1,511	19	19	32	22	1,531	17	11	20	10
Sep	1,388	18	18	29	20	1,407	16	7	18	6

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S1)

Note:
Simulation period: 1922-2003

Key:
Alt =alternative
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Below Keswick Dam, Sacramento River flows would be increasingly affected by tributary inflows rather than releases from Shasta Lake. Table 6-8 shows the input monthly average tributary inflows to the Sacramento River between Keswick Dam and RBPP. The tributary inflows are consistent between the 2005 and 2030 levels of development simulations and for each alternative. Below RBPP, flow changes associated with the SLWRI alternatives would be considerably smaller relative to total flow in the river.

Table 6-8. Input Monthly Average Tributary Inflow to the Sacramento River between Keswick Dam and Red Bluff Pumping Plant

Month	Cottonwood Creek (cfs)	Paynes Creek (cfs)
October	109	23
November	335	77
December	1,073	145
January	1,848	179
February	2,252	174
March	1,803	128
April	1,139	70
May	619	37
June	298	23
July	108	10
August	64	7
September	70	13
Total (AF)	584,937	53,402

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node I108 and I110)
Notes:
Simulation period: 1922-2003
Key:
AF = acre-feet
Alt = alternative
cfs = cubic feet per second
SLWRI = Shasta Lake Water Resources Investigation

Tributary influence on Sacramento River monthly average flows is apparent when existing condition and No-Action Alternative total flows are compared (see Tables 6-4 and 6-9). Total flows are greater downstream from RBPP, after several tributaries have entered the Sacramento River, than they are immediately downstream from Shasta Dam.

Table 6-9. Simulated Monthly Average Sacramento River Flows Below Red Bluff Pumping Plant

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alts (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	6,959	90 (1%)	180 (3%)	131 (2%)	179 (3%)	6,927	117 (2%)	147 (2%)	142 (2%)	180 (3%)
November	8,802	88 (1%)	142 (2%)	129 (1%)	114 (1%)	8,721	81 (1%)	155 (2%)	200 (2%)	165 (2%)
December	11,683	-291 (-2%)	-348 (-3%)	-518 (-4%)	-574 (-5%)	11,595	-280 (-2%)	-450 (-4%)	-627 (-5%)	-599 (-5%)
January	15,241	-138 (-1%)	-291 (-2%)	-354 (-2%)	-365 (-2%)	15,245	-228 (-1%)	-319 (-2%)	-425 (-3%)	-404 (-3%)
February	18,111	-189 (-1%)	-272 (-2%)	-292 (-2%)	-372 (-2%)	18,186	-212 (-1%)	-339 (-2%)	-366 (-2%)	-465 (-3%)
March	14,544	-48 (0%)	-121 (-1%)	-168 (-1%)	-168 (-1%)	14,586	-37 (0%)	-110 (-1%)	-179 (-1%)	-175 (-1%)
April	10,615	-7 (0%)	-4 (0%)	52 (0%)	33 (0%)	10,580	19 (0%)	41 (0%)	81 (1%)	50 (0%)
May	9,551	-50 (-1%)	-76 (-1%)	-73 (-1%)	-78 (-1%)	9,554	-39 (0%)	-56 (-1%)	-31 (0%)	-46 (0%)
June	10,903	-3 (0%)	15 (0%)	-2 (0%)	42 (0%)	10,971	56 (1%)	70 (1%)	17 (0%)	68 (1%)
July	12,424	107 (1%)	163 (1%)	81 (1%)	186 (1%)	12,510	48 (0%)	117 (1%)	42 (0%)	143 (1%)
August	9,782	22 (0%)	13 (0%)	55 (1%)	16 (0%)	9,863	57 (1%)	103 (1%)	159 (2%)	114 (1%)
September	8,009	141 (2%)	178 (2%)	200 (3%)	328 (4%)	8,271	151 (2%)	248 (3%)	240 (3%)	344 (4%)
Total (TAF)	8,217	-16 (0%)	-25 (0%)	-46 (-1%)	-39 (0%)	8,240	-16 (0%)	-23 (0%)	-45 (-1%)	-37 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C112)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative

Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

In addition to the multiple tributary inflows between Keswick Dam and Red Bluff, downstream flows on the Sacramento River would be affected by diversions above RBPP. Specifically, contractors off Tehama-Colusa Canal receive supplies from above the RBPP. Because contractors off Tehama-Colusa Canal are all water service contractors, and thus would be subject to delivery shortages when CVP storage is low, the SLWRI alternatives would result in increased deliveries to Tehama-Colusa Canal contractors in relatively dry years. Table 6-10 shows simulated diversions from RBPP to Tehama-Colusa Canal in dry and critical years. Agricultural diversions typically occur between April and September, with some additional diversions in March and October; accordingly, deliveries on Tehama-Colusa Canal increase in the agricultural diversion months, but see no changes in other months with little or no irrigation.

Table 6-10. Simulated Monthly Average Diversions to Tehama-Colusa Canal in Dry and Critical Years

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	111	2 (2%)	2 (2%)	7 (7%)	5 (4%)	106	1 (1%)	3 (3%)	8 (8%)	6 (5%)
November	10	0 (0%)	0 (1%)	0 (3%)	0 (2%)	10	0 (0%)	0 (1%)	0 (3%)	0 (2%)
December	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	7	0 (1%)	0 (0%)	0 (2%)	0 (1%)	5	0 (0%)	0 (0%)	0 (1%)	0 (1%)
March	21	2 (10%)	2 (11%)	7 (31%)	5 (23%)	15	1 (9%)	2 (16%)	7 (47%)	5 (34%)
April	154	10 (6%)	15 (10%)	39 (26%)	31 (20%)	129	2 (2%)	-3 (-3%)	21 (17%)	10 (8%)
May	252	22 (9%)	28 (11%)	64 (25%)	58 (23%)	219	16 (7%)	23 (10%)	69 (31%)	50 (23%)
June	438	24 (6%)	30 (7%)	82 (19%)	64 (15%)	430	12 (3%)	27 (6%)	86 (20%)	64 (15%)
July	497	26 (5%)	32 (7%)	92 (19%)	69 (14%)	437	13 (3%)	30 (7%)	98 (22%)	70 (16%)
August	450	21 (5%)	26 (6%)	73 (16%)	55 (12%)	403	11 (3%)	24 (6%)	78 (19%)	56 (14%)
September	108	10 (9%)	20 (18%)	33 (31%)	27 (25%)	90	7 (8%)	15 (17%)	30 (34%)	26 (29%)
Total (TAF)	125	7 (6%)	9 (8%)	24 (19%)	19 (15%)	112	4 (3%)	7 (7%)	24 (22%)	17 (16%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node D112)

Notes:
Simulation period: 1922-2003
Dry and critical years as defined by the Sacramento Valley Index

Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Although Tehama-Colusa Canal water users are the primary recipient of CVP water service contract deliveries north of the Delta, other north-of-the-Delta users are subject to changes in water supply, including wildlife refuges. Average monthly deliveries to CVP water service contractors and refuges north of the Delta are included in Table 6-11.

Table 6-11. Simulated Monthly Average Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	254	-7 (-3%)	-4 (-2%)	1 (0%)	-3 (-1%)	297	4 (1%)	6 (2%)	18 (6%)	3 (1%)
November	170	2 (1%)	3 (2%)	1 (0%)	1 (0%)	222	-1 (0%)	1 (0%)	1 (0%)	2 (1%)
December	105	0 (0%)	0 (0%)	0 (0%)	0 (0%)	133	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)	63	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	48	0 (0%)	0 (0%)	0 (0%)	0 (0%)	59	0 (0%)	0 (0%)	0 (0%)	0 (0%)
March	32	1 (3%)	2 (5%)	5 (14%)	4 (11%)	31	1 (2%)	2 (6%)	5 (15%)	4 (12%)
April	350	12 (3%)	19 (5%)	44 (13%)	34 (10%)	316	13 (4%)	23 (7%)	47 (15%)	38 (12%)
May	622	14 (2%)	24 (4%)	60 (10%)	46 (7%)	619	15 (2%)	30 (5%)	68 (11%)	53 (9%)
June	878	18 (2%)	29 (3%)	76 (9%)	57 (7%)	884	20 (2%)	38 (4%)	87 (10%)	67 (8%)
July	1,024	20 (2%)	33 (3%)	85 (8%)	63 (6%)	1,044	19 (2%)	38 (4%)	96 (9%)	74 (7%)
August	876	17 (2%)	25 (3%)	66 (8%)	50 (6%)	907	18 (2%)	35 (4%)	78 (9%)	61 (7%)
September	527	8 (1%)	12 (2%)	30 (6%)	22 (4%)	572	8 (1%)	15 (3%)	34 (6%)	26 (5%)
Total (TAF)	299	5 (2%)	9 (3%)	22 (7%)	17 (6%)	312	6 (2%)	11 (4%)	26 (8%)	20 (6%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

As would be expected, the change in deliveries increases with the greater enlargement volumes, and increases in deliveries are much greater in the dry and critical years than in average years, corresponding to the increased likelihood of shortages during drier periods. Table 6-12 shows average deliveries in dry and critical years.

Table 6-12. Simulated Monthly Average Deliveries to North-of-Delta CVP Water Service Contractors and Refuges in Dry and Critical Years

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	251	-22 (-9%)	-14 (-6%)	-4 (-2%)	-25 (-10%)	275	10 (4%)	15 (6%)	40 (15%)	3 (1%)
November	159	5 (3%)	11 (7%)	3 (2%)	4 (3%)	215	-4 (-2%)	-1 (-1%)	-4 (-2%)	1 (0%)
December	104	0 (0%)	0 (0%)	0 (0%)	0 (0%)	132	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	50	0 (0%)	0 (0%)	0 (0%)	0 (0%)	62	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	52	0 (0%)	0 (0%)	0 (0%)	0 (0%)	62	0 (0%)	0 (0%)	0 (0%)	0 (0%)
March	33	2 (7%)	2 (7%)	7 (20%)	5 (15%)	29	2 (5%)	3 (9%)	7 (25%)	5 (19%)
April	243	14 (6%)	21 (9%)	53 (22%)	42 (17%)	199	11 (5%)	21 (11%)	57 (29%)	42 (21%)
May	363	17 (5%)	25 (7%)	69 (19%)	52 (14%)	328	11 (3%)	24 (7%)	75 (23%)	54 (16%)
June	500	24 (5%)	29 (6%)	88 (18%)	66 (13%)	452	16 (3%)	32 (7%)	99 (22%)	72 (16%)
July	579	26 (4%)	36 (6%)	100 (17%)	73 (13%)	540	11 (2%)	29 (5%)	106 (20%)	79 (15%)
August	520	23 (4%)	27 (5%)	77 (15%)	61 (12%)	498	18 (4%)	36 (7%)	90 (18%)	71 (14%)
September	348	10 (3%)	14 (4%)	36 (10%)	27 (8%)	370	6 (2%)	12 (3%)	39 (10%)	27 (7%)
Total (TAF)	194	6 (3%)	9 (5%)	26 (13%)	19 (10%)	192	5 (3%)	10 (5%)	31 (16%)	22 (11%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Dry and critical years as defined by the Sacramento Valley Index
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Table 6-13 shows the input monthly average tributary inflows to the Sacramento River below RBPP. The tributary inflows are the same in the 2005 and 2030 levels of development simulations.

Table 6-13. Input Monthly Average Tributary Inflow to the Sacramento River Below Red Bluff Pumping Plant

Month	Thomes and Elder Creeks (cfs)	Antelope, Mill, and Deer Creeks (cfs)
October	32	397
November	227	712
December	626	1,412
January	881	1,878
February	1,115	2,122
March	976	1,919
April	791	1,699
May	503	1,350
June	172	817
July	36	454
August	8	350
September	10	335
Total (AF)	323,806	811,287

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node I1301 and I1305)
Note:
Simulation period: 1922-2003
Key:
AF = acre-feet
cfs = cubic feet per second
SLWRI = Shasta Lake Water Resources Investigation

As described in Chapter 1 of the *Hydrology, Hydraulics, and Water Management Technical Report*, during high flow periods, Sacramento River flows below Red Bluff can be diverted into the Sutter Bypass near Ord Ferry, or from the Moulton, Colusa, or Tisdale weirs. Similarly, flows can be diverted into the Yolo Bypass from the Fremont and Sacramento weirs. Table 6-14 shows the recurrence of annual spills over the various Sacramento Valley weirs into the Sutter and Yolo bypasses.

Table 6-14. Simulated Number of Years of Sacramento Valley Weir Spill

Location	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition	Change from Base				No-Action Alt	Change from Base			
		CP1 and CP4	CP2	CP3	CP5		CP1 and CP4	CP2	CP3	CP5
Spill Above Moulton Weir	2	0	0	0	0	2	0	0	0	0
Moulton Weir	15	0	0	0	0	16	-1	-1	-1	-2
Colusa Weir	39	-1	-2	-2	-3	39	-2	-2	-3	-4
Tisdale Weir	53	-1	-1	-1	-1	54	0	0	-1	-1
Fremont Weir	49	0	0	0	0	48	0	1	0	0
Sacramento Weir	50	0	0	1	0	49	0	1	1	1

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node D117, D124, D125, D126, D160, D166A)
Note:
Simulation period: 1922-2003
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation

As the Sacramento River nears the Delta, the basis-of-comparison flow would increase considerably so that flow changes associated with SLWRI alternatives would be miniscule in most months. Table 6-15 shows the simulated monthly average Sacramento River flow below Freeport. Flow changes because of each alternative are small compared to the bases of comparison; average monthly flow changes are typically between 0 percent and 2 percent. Larger flow increases are because of operations specifically for export; since conditions typically only allow for increased exports in July, August, and September, the majority of the changes are observed during those months.

Table 6-15. Simulated Monthly Average Sacramento River Flows Below Freeport

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	11,309	80 (1%)	92 (1%)	107 (1%)	107 (1%)	11,117	67 (1%)	94 (1%)	102 (1%)	113 (1%)
November	15,640	37 (0%)	95 (1%)	63 (0%)	70 (0%)	15,605	25 (0%)	95 (1%)	119 (1%)	89 (1%)
December	23,248	-67 (0%)	-22 (0%)	-92 (0%)	-106 (0%)	23,229	-55 (0%)	-105 (0%)	-133 (-1%)	-139 (-1%)
January	31,139	5 (0%)	-77 (0%)	-70 (0%)	-93 (0%)	31,167	-31 (0%)	-61 (0%)	-106 (0%)	-91 (0%)
February	36,608	-41 (0%)	-12 (0%)	-30 (0%)	-49 (0%)	36,618	-32 (0%)	-56 (0%)	-84 (0%)	-129 (0%)
March	32,396	-29 (0%)	-64 (0%)	-54 (0%)	-95 (0%)	32,352	-9 (0%)	-34 (0%)	-90 (0%)	-68 (0%)
April	23,232	10 (0%)	14 (0%)	49 (0%)	58 (0%)	23,206	16 (0%)	41 (0%)	87 (0%)	51 (0%)
May	19,417	-48 (0%)	-76 (0%)	-65 (0%)	-68 (0%)	19,114	-45 (0%)	-68 (0%)	-49 (0%)	-59 (0%)
June	16,508	-54 (0%)	-53 (0%)	-33 (0%)	-56 (0%)	16,511	-23 (0%)	-48 (0%)	-62 (0%)	-90 (-1%)
July	19,518	12 (0%)	32 (0%)	11 (0%)	60 (0%)	19,266	37 (0%)	67 (0%)	54 (0%)	119 (1%)
August	14,710	33 (0%)	11 (0%)	-15 (0%)	7 (0%)	14,596	41 (0%)	67 (0%)	94 (1%)	101 (1%)
September	18,211	102 (1%)	127 (1%)	46 (0%)	237 (1%)	18,417	146 (1%)	251 (1%)	127 (1%)	316 (2%)
Total (TAF)	15,742	2 (0%)	4 (0%)	-5 (0%)	4 (0%)	15,696	8 (0%)	15 (0%)	4 (0%)	13 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C169)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Because of the interconnected nature of CVP and SWP operations for meeting shared Sacramento River flow requirements and Delta water quality obligations, changes in Shasta Reservoir operations could potentially affect operations of both Oroville Reservoir on the Feather River and Folsom Reservoir on the American River. For example, an increase in Shasta Reservoir releases may create opportunities for increased SWP export of releases from Oroville Reservoir by improving Delta water quality. Tables 6-16 and 6-17 show simulated end-of-month storage at Oroville Reservoir and Feather River flow below the Thermalito Afterbay, respectively.

Table 6-16. Simulated Average End-of-Month Oroville Reservoir Storage

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (TAF)	Change from Base				No-Action Alt (TAF)	Change from Base			
		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)
October	1,789	8 (0%)	15 (1%)	2 (0%)	17 (1%)	1,737	8 (0%)	13 (1%)	2 (0%)	15 (1%)
November	1,845	6 (0%)	12 (1%)	0 (0%)	14 (1%)	1,796	8 (0%)	13 (1%)	2 (0%)	14 (1%)
December	1,965	5 (0%)	10 (0%)	1 (0%)	11 (1%)	1,929	7 (0%)	12 (1%)	0 (0%)	13 (1%)
January	2,173	4 (0%)	9 (0%)	0 (0%)	11 (0%)	2,143	8 (0%)	13 (1%)	0 (0%)	14 (1%)
February	2,381	3 (0%)	8 (0%)	0 (0%)	9 (0%)	2,365	7 (0%)	12 (1%)	1 (0%)	14 (1%)
March	2,591	3 (0%)	8 (0%)	-1 (0%)	9 (0%)	2,581	6 (0%)	10 (0%)	3 (0%)	11 (0%)
April	2,866	3 (0%)	8 (0%)	-1 (0%)	9 (0%)	2,857	6 (0%)	10 (0%)	3 (0%)	12 (0%)
May	2,998	4 (0%)	8 (0%)	-1 (0%)	9 (0%)	2,992	5 (0%)	10 (0%)	3 (0%)	11 (0%)
June	2,894	7 (0%)	13 (0%)	-2 (0%)	16 (1%)	2,877	9 (0%)	16 (1%)	2 (0%)	19 (1%)
July	2,427	9 (0%)	17 (1%)	-1 (0%)	20 (1%)	2,408	9 (0%)	14 (1%)	-1 (0%)	16 (1%)
August	2,150	9 (0%)	16 (1%)	0 (0%)	19 (1%)	2,113	11 (1%)	17 (1%)	3 (0%)	19 (1%)
September	1,856	8 (0%)	14 (1%)	4 (0%)	17 (1%)	1,794	8 (0%)	11 (1%)	2 (0%)	13 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S6)

Note:

Simulation period: 1922-2003

Key:

Alt = alternative

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Table 6-17. Simulated Monthly Average Feather River Flow below the Thermalito Afterbay

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	2,924	-15 (-1%)	-22 (-1%)	35 (1%)	-13 (0%)	2,778	-11 (0%)	-27 (-1%)	10 (0%)	-35 (-1%)
November	2,231	31 (1%)	36 (2%)	24 (1%)	42 (2%)	2,165	7 (0%)	11 (1%)	1 (0%)	23 (1%)
December	3,742	34 (1%)	46 (1%)	-18 (0%)	65 (2%)	3,523	13 (0%)	7 (0%)	27 (1%)	15 (0%)
January	4,551	16 (0%)	18 (0%)	18 (0%)	14 (0%)	4,453	-5 (0%)	-15 (0%)	-7 (0%)	-3 (0%)
February	5,582	10 (0%)	23 (0%)	-1 (0%)	25 (0%)	5,354	11 (0%)	11 (0%)	-15 (0%)	1 (0%)
March	5,962	0 (0%)	3 (0%)	17 (0%)	-2 (0%)	5,854	26 (0%)	34 (1%)	-20 (0%)	41 (1%)
April	3,058	1 (0%)	1 (0%)	1 (0%)	1 (0%)	3,063	-4 (0%)	-5 (0%)	-3 (0%)	-7 (0%)
May	3,725	-3 (0%)	-2 (0%)	-1 (0%)	0 (0%)	3,684	9 (0%)	7 (0%)	-8 (0%)	9 (0%)
June	3,575	-66 (-2%)	-91 (-3%)	24 (1%)	-114 (-3%)	3,746	-68 (-2%)	-104 (-3%)	22 (1%)	-135 (-4%)
July	7,478	-38 (-1%)	-75 (-1%)	-19 (0%)	-77 (-1%)	7,512	2 (0%)	29 (0%)	47 (1%)	41 (1%)
August	4,557	4 (0%)	19 (0%)	-21 (0%)	17 (0%)	4,855	-33 (-1%)	-51 (-1%)	-71 (-1%)	-55 (-1%)
September	5,301	14 (0%)	38 (1%)	-67 (-1%)	31 (1%)	5,699	53 (1%)	92 (2%)	26 (0%)	95 (2%)
Total (TAF)	3,178	-1 (0%)	0 (0%)	0 (0%)	-1 (0%)	3,178	0 (0%)	-1 (0%)	1 (0%)	-1 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C203)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative

Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Similarly, an increase in Shasta Reservoir releases in a particular month may result in improved Delta water quality, allowing for a possible reduction in CVP releases from the American River, and a corresponding increase in Folsom Reservoir storage. Tables 6-18 and 6-19 show simulated end-of-month storage at Folsom Reservoir and on the American River near the H-Street Bridge, respectively.

Table 6-18. Simulated Average End-of-Month Folsom Reservoir Storage

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (TAF)	Change from Base				No-Action Alt (TAF)	Change from Base			
		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)		CP1 and CP4 (TAF)	CP2 (TAF)	CP3 (TAF)	CP5 (TAF)
October	487	9 (2%)	18 (4%)	25 (5%)	19 (4%)	479	9 (2%)	13 (3%)	20 (4%)	13 (3%)
November	447	15 (3%)	25 (6%)	32 (7%)	27 (6%)	441	16 (4%)	20 (5%)	28 (6%)	22 (5%)
December	459	8 (2%)	14 (3%)	18 (4%)	14 (3%)	453	9 (2%)	11 (2%)	16 (3%)	11 (3%)
January	475	6 (1%)	10 (2%)	14 (3%)	10 (2%)	473	6 (1%)	6 (1%)	12 (2%)	8 (2%)
February	492	3 (1%)	6 (1%)	8 (2%)	6 (1%)	494	3 (1%)	2 (0%)	7 (1%)	4 (1%)
March	594	3 (0%)	5 (1%)	7 (1%)	5 (1%)	599	3 (1%)	2 (0%)	5 (1%)	3 (0%)
April	723	2 (0%)	4 (1%)	6 (1%)	4 (1%)	725	3 (0%)	1 (0%)	5 (1%)	2 (0%)
May	844	2 (0%)	4 (0%)	6 (1%)	4 (0%)	846	4 (0%)	2 (0%)	5 (1%)	3 (0%)
June	820	1 (0%)	3 (0%)	9 (1%)	3 (0%)	814	4 (1%)	3 (0%)	10 (1%)	5 (1%)
July	681	5 (1%)	6 (1%)	12 (2%)	6 (1%)	669	5 (1%)	8 (1%)	12 (2%)	8 (1%)
August	608	4 (1%)	7 (1%)	14 (2%)	7 (1%)	597	4 (1%)	6 (1%)	10 (2%)	5 (1%)
September	509	7 (1%)	13 (3%)	19 (4%)	14 (3%)	505	7 (1%)	11 (2%)	18 (3%)	12 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S8)

Note:

Simulation period: 1922-2003

Key:

Alt = alternative

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Table 6-19. Simulated Monthly Average American River Flow near the H Street Bridge

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	1,522	-32 (-2%)	-93 (-6%)	-88 (-6%)	-81 (-5%)	1,347	-43 (-3%)	-29 (-2%)	-53 (-4%)	-34 (-3%)
November	2,670	-101 (-4%)	-107 (-4%)	-117 (-4%)	-123 (-5%)	2,482	-104 (-4%)	-118 (-5%)	-125 (-5%)	-143 (-6%)
December	3,272	109 (3%)	174 (5%)	224 (7%)	198 (6%)	3,102	116 (4%)	151 (5%)	192 (6%)	170 (5%)
January	4,364	43 (1%)	64 (1%)	66 (2%)	66 (2%)	4,175	46 (1%)	65 (2%)	66 (2%)	58 (1%)
February	5,113	45 (1%)	77 (2%)	93 (2%)	70 (1%)	4,869	46 (1%)	70 (1%)	84 (2%)	70 (1%)
March	3,696	6 (0%)	11 (0%)	18 (0%)	15 (0%)	3,496	-1 (0%)	8 (0%)	19 (1%)	9 (0%)
April	3,155	17 (1%)	15 (0%)	20 (1%)	19 (1%)	2,813	0 (0%)	5 (0%)	5 (0%)	5 (0%)
May	3,429	2 (0%)	0 (0%)	9 (0%)	10 (0%)	2,982	-11 (0%)	-13 (0%)	-8 (0%)	-17 (-1%)
June	3,413	8 (0%)	19 (1%)	-59 (-2%)	11 (0%)	2,955	-12 (0%)	-19 (-1%)	-101 (-3%)	-29 (-1%)
July	3,593	-55 (-2%)	-52 (-1%)	-50 (-1%)	-49 (-1%)	3,070	-9 (0%)	-73 (-2%)	-33 (-1%)	-67 (-2%)
August	2,321	12 (1%)	-19 (-1%)	-40 (-2%)	-18 (-1%)	1,754	29 (2%)	17 (1%)	15 (1%)	51 (3%)
September	2,898	-57 (-2%)	-97 (-3%)	-98 (-3%)	-133 (-5%)	2,378	-56 (-2%)	-96 (-4%)	-129 (-5%)	-128 (-5%)
Total (TAF)	2,371	0 (0%)	-1 (0%)	-1 (0%)	-1 (0%)	2,128	0 (0%)	-2 (0%)	-4 (0%)	-3 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C302)

Notes:

Simulation period: 1922-2003

(%) indicates percent change from either existing condition or No-Action Alternative

Key:

Alt = alternative

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

The Delta is the confluence of the Sacramento, San Joaquin, Cosumnes, Calaveras, and Mokelumne rivers in addition to several other smaller streams and creeks. As the “central hub” of California’s water supplies, minor changes in operations in one region could result in other minor changes throughout the system. As previously described, changes in operations associated with the SLWRI alternatives could possibly result in minor changes in operations to other CVP and SWP facilities. New Melones Reservoir on the Stanislaus River is operated by the CVP to meet water quality requirements in the lower San Joaquin River only, not in the South Delta, and would not be expected to be affected by changes in Sacramento River flow or Delta exports. Simulations indicate the SLWRI alternatives would not result in any changes to New Melones operations. (See Attachment 1 of the Modeling Appendix for details about New Melones Reservoir and Stanislaus River operations.)

Besides potentially changing exports to south-of-Delta water users, changes in Delta inflow could also be reflected in changes in Delta outflow. Changes in Sacramento River flow, as shown above in Table 6-15, are typically reflected as a combination of Delta outflow and export. Table 6-20 shows changes in Delta outflow associated with each alternative.

Table 6-20. Simulated Monthly Average Change in Delta Outflow

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	6,067	-4 (0%)	14 (0%)	-11 (0%)	5 (0%)	6,000	2 (0%)	0 (0%)	-19 (0%)	3 (0%)
November	11,706	-157 (-1%)	-157 (-1%)	-165 (-1%)	-175 (-1%)	11,675	-150 (-1%)	-174 (-1%)	-191 (-2%)	-209 (-2%)
December	21,755	-153 (-1%)	-134 (-1%)	-327 (-2%)	-318 (-1%)	21,745	-152 (-1%)	-274 (-1%)	-359 (-2%)	-421 (-2%)
January	42,078	-77 (0%)	-218 (-1%)	-296 (-1%)	-262 (-1%)	42,169	-198 (0%)	-277 (-1%)	-400 (-1%)	-363 (-1%)
February	51,618	-92 (0%)	-160 (0%)	-187 (0%)	-278 (-1%)	51,430	-156 (0%)	-235 (0%)	-303 (-1%)	-396 (-1%)
March	42,722	-71 (0%)	-142 (0%)	-146 (0%)	-191 (0%)	42,585	-3 (0%)	-55 (0%)	-157 (0%)	-116 (0%)
April	30,227	9 (0%)	12 (0%)	73 (0%)	55 (0%)	30,743	13 (0%)	39 (0%)	83 (0%)	51 (0%)
May	22,619	-52 (0%)	-80 (0%)	-67 (0%)	-71 (0%)	22,249	-53 (0%)	-79 (0%)	-40 (0%)	-70 (0%)
June	12,829	-52 (0%)	-69 (-1%)	-49 (0%)	-73 (-1%)	12,660	-41 (0%)	-65 (-1%)	-78 (-1%)	-110 (-1%)
July	7,864	0 (0%)	5 (0%)	13 (0%)	0 (0%)	7,864	5 (0%)	-3 (0%)	-1 (0%)	-9 (0%)
August	4,322	16 (0%)	21 (0%)	-6 (0%)	13 (0%)	4,335	14 (0%)	22 (1%)	-7 (0%)	19 (0%)
September	9,841	-2 (0%)	4 (0%)	-5 (0%)	25 (0%)	9,844	14 (0%)	38 (0%)	20 (0%)	53 (1%)
Total (TAF)	15,776	-38 (0%)	-54 (0%)	-71 (0%)	-76 (0%)	15,755	-42 (0%)	-64 (0%)	-87 (-1%)	-94 (-1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node C406)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

The CVP and SWP divert water via the Jones Pumping Plant and the Banks Pumping Plant, respectively. The increased water supply made available from the SLWRI alternatives would typically be moved through the Jones Pumping Plant. However, even under existing conditions or No-Action Alternative (the bases of comparison), pumping capacity at Jones is often already maximized in wetter years, leaving little ability to export any additional water due to physical pumping limits or regulatory pumping restrictions. Accordingly, although unmet CVP demand south of the Delta may exist in some relatively wet years, conveyance restrictions could limit opportunities to export available water south of the Delta in those years. In drier years, however, capacity is typically available to increase pumping at Jones Pumping Plant, and with the increase in Shasta storage there is an increase in water supply available for pumping. Thus, there are greater increases in average annual pumping volumes in drier years. Tables 6-21 and 6-22 show the average annual exports through Jones Pumping Plant in all years and dry and critical years only respectively.

Table 6-21. Simulated Monthly Average Exports Through Jones Pumping Plant

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	3,662	-2 (0%)	-33 (-1%)	50 (1%)	-34 (-1%)	3,566	-14 (0%)	-3 (0%)	71 (2%)	-27 (-1%)
November	3,793	111 (3%)	139 (4%)	146 (4%)	129 (3%)	3,670	111 (3%)	170 (5%)	213 (6%)	184 (5%)
December	4,008	1 (0%)	-11 (0%)	12 (0%)	-7 (0%)	3,957	4 (0%)	15 (0%)	-2 (0%)	37 (1%)
January	3,207	11 (0%)	57 (2%)	28 (1%)	48 (1%)	3,154	18 (1%)	5 (0%)	36 (1%)	16 (1%)
February	3,229	-38 (-1%)	-7 (0%)	-15 (0%)	14 (0%)	3,127	9 (0%)	14 (0%)	31 (1%)	52 (2%)
March	2,953	17 (1%)	37 (1%)	-9 (0%)	22 (1%)	2,967	-42 (-1%)	-33 (-1%)	-24 (-1%)	-26 (-1%)
April	1,082	0 (0%)	0 (0%)	2 (0%)	2 (0%)	1,179	1 (0%)	1 (0%)	2 (0%)	3 (0%)
May	1,114	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1,102	1 (0%)	1 (0%)	2 (0%)	1 (0%)
June	2,431	-5 (0%)	11 (0%)	10 (0%)	-1 (0%)	2,453	11 (0%)	3 (0%)	-13 (-1%)	-3 (0%)
July	4,011	7 (0%)	10 (0%)	28 (1%)	35 (1%)	3,925	-18 (0%)	-36 (-1%)	7 (0%)	-18 (0%)
August	4,044	-66 (-2%)	-148 (-4%)	18 (0%)	-171 (-4%)	3,897	6 (0%)	-15 (0%)	162 (4%)	-8 (0%)
September	3,904	32 (1%)	15 (0%)	70 (2%)	110 (3%)	3,888	49 (1%)	65 (2%)	101 (3%)	123 (3%)
Total (TAF)	2,261	4 (0%)	4 (0%)	21 (1%)	8 (0%)	2,227	8 (0%)	11 (0%)	35 (2%)	20 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node D418)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Table 6-22. Simulated Monthly Average Exports Through Jones Pumping Plant in Dry and Critical Years

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)		Change from Base		
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	3,591	4 (0%)	-59 (-2%)	78 (2%)	-65 (-2%)	3,448	-18 (-1%)	11 (0%)	109 (3%)	0 (0%)
November	3,509	105 (3%)	145 (4%)	140 (4%)	145 (4%)	3,396	157 (5%)	237 (7%)	279 (8%)	234 (7%)
December	3,939	14 (0%)	-57 (-1%)	4 (0%)	-41 (-1%)	3,765	-1 (0%)	23 (1%)	-23 (-1%)	67 (2%)
January	3,058	31 (1%)	140 (5%)	41 (1%)	120 (4%)	2,946	29 (1%)	30 (1%)	37 (1%)	18 (1%)
February	2,757	-10 (0%)	55 (2%)	-5 (0%)	85 (3%)	2,602	50 (2%)	93 (4%)	70 (3%)	159 (6%)
March	1,956	30 (2%)	84 (4%)	-19 (-1%)	44 (2%)	1,921	-36 (-2%)	-3 (0%)	-10 (-1%)	0 (0%)
April	931	0 (0%)	0 (0%)	0 (0%)	0 (0%)	963	1 (0%)	11 (1%)	11 (1%)	11 (1%)
May	857	1 (0%)	-1 (0%)	0 (0%)	0 (0%)	850	2 (0%)	4 (0%)	5 (1%)	4 (0%)
June	1,139	-15 (-1%)	-18 (-2%)	-8 (-1%)	-25 (-2%)	1,102	-15 (-1%)	-45 (-4%)	-27 (-2%)	-23 (-2%)
July	3,379	14 (0%)	21 (1%)	27 (1%)	67 (2%)	3,180	-26 (-1%)	-60 (-2%)	23 (1%)	-19 (-1%)
August	3,402	-173 (-5%)	-353 (-10%)	87 (3%)	-433 (-13%)	2,996	45 (2%)	-4 (0%)	438 (15%)	17 (1%)
September	3,358	78 (2%)	42 (1%)	79 (2%)	215 (6%)	3,253	81 (3%)	133 (4%)	127 (4%)	198 (6%)
Total (TAF)	1,926	5 (0%)	-1 (0%)	26 (1%)	6 (0%)	1,838	16 (1%)	25 (1%)	63 (3%)	39 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node D418)

Notes:
Simulation period: 1922-2003
Dry and critical years as defined by the Sacramento Valley Index
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Recipients of exports through the Jones Pumping Plant include San Joaquin Valley Exchange Contractors, Federal wildlife refuges, and water service contractors. Because the Exchange Contractors have substantially higher levels of reliability of delivery compared to the refuges and water service contractors, their deliveries will not change under any of the SLWRI alternatives. Deliveries to the refuges and water service contractors would increase with an enlargement of Shasta Dam.

Tables 6-23 and 6-24 show the mean monthly delivery to the CVP south-of-Delta refuges and water service contractors for all years and for dry and critical years respectively. Differences in timing between exports through the Jones and Banks pumping plants and deliveries to CVP and SWP contractors are because of the ability of both projects to store water in San Luis Reservoir during winter months and to use that storage to augment Delta exports in summer months. (Attachment 1 of the Modeling Appendix includes information about San Luis Reservoir storage.)

Table 6-23. Simulated Monthly Average Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
Oct	1,600	3 (0%)	4 (0%)	10 (1%)	6 (0%)	1,505	6 (0%)	8 (1%)	19 (1%)	13 (1%)
Nov	1,091	3 (0%)	3 (0%)	8 (1%)	4 (0%)	1,025	4 (0%)	6 (1%)	15 (1%)	10 (1%)
Dec	837	3 (0%)	4 (0%)	10 (1%)	6 (1%)	796	6 (1%)	8 (1%)	20 (3%)	13 (2%)
Jan	1,027	6 (1%)	7 (1%)	18 (2%)	11 (1%)	998	10 (1%)	14 (1%)	35 (4%)	23 (2%)
Feb	1,209	8 (1%)	9 (1%)	23 (2%)	13 (1%)	1,178	13 (1%)	18 (1%)	44 (4%)	29 (2%)
Mar	753	13 (2%)	15 (2%)	35 (5%)	22 (3%)	722	15 (2%)	20 (3%)	49 (7%)	35 (5%)
Apr	1,296	11 (1%)	13 (1%)	31 (2%)	20 (2%)	1,254	15 (1%)	23 (2%)	54 (4%)	38 (3%)
May	2,009	11 (1%)	12 (1%)	32 (2%)	18 (1%)	1,935	19 (1%)	25 (1%)	63 (3%)	41 (2%)
Jun	3,088	28 (1%)	30 (1%)	64 (2%)	37 (1%)	3,001	32 (1%)	42 (1%)	106 (4%)	69 (2%)
Jul	3,256	20 (1%)	23 (1%)	65 (2%)	34 (1%)	3,175	37 (1%)	38 (1%)	114 (4%)	70 (2%)
Aug	2,275	3 (0%)	15 (1%)	65 (3%)	19 (1%)	2,244	12 (1%)	25 (1%)	93 (4%)	44 (2%)
Sep	1,620	-10 (-1%)	-8 (0%)	-2 (0%)	-2 (0%)	1,531	10 (1%)	20 (1%)	31 (2%)	26 (2%)
Total (TAF)	1,212	6 (0%)	8 (1%)	22 (2%)	11 (1%)	1,170	11 (1%)	15 (1%)	39 (3%)	25 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CVP = Central Valley Project
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Table 6-24. Simulated Monthly Average Deliveries to South-of-Delta CVP Water Service Contractors and Refuges in Dry and Critical Years

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	1,473	6 (0%)	4 (0%)	15 (1%)	11 (1%)	1,369	8 (1%)	12 (1%)	27 (2%)	21 (2%)
November	996	4 (0%)	3 (0%)	12 (1%)	8 (1%)	923	6 (1%)	9 (1%)	21 (2%)	16 (2%)
December	715	6 (1%)	4 (1%)	16 (2%)	11 (2%)	664	8 (1%)	12 (2%)	29 (4%)	23 (3%)
January	818	10 (1%)	8 (1%)	29 (3%)	20 (2%)	771	14 (2%)	22 (3%)	51 (7%)	40 (5%)
February	948	13 (1%)	10 (1%)	36 (4%)	25 (3%)	895	18 (2%)	27 (3%)	63 (7%)	50 (6%)
March	451	15 (3%)	9 (2%)	26 (6%)	17 (4%)	385	6 (2%)	12 (3%)	53 (14%)	37 (10%)
April	834	-1 (0%)	-10 (-1%)	2 (0%)	-9 (-1%)	737	5 (1%)	11 (1%)	51 (7%)	34 (5%)
May	1,325	-2 (0%)	-14 (-1%)	2 (0%)	-11 (-1%)	1,181	11 (1%)	19 (2%)	72 (6%)	45 (4%)
June	1,935	23 (1%)	5 (0%)	31 (2%)	0 (0%)	1,743	19 (1%)	32 (2%)	122 (7%)	76 (4%)
July	1,923	-10 (-1%)	-34 (-2%)	0 (0%)	-30 (-2%)	1,688	19 (1%)	4 (0%)	109 (6%)	56 (3%)
August	1,296	-39 (-3%)	-28 (-2%)	50 (4%)	-33 (-3%)	1,100	38 (3%)	63 (6%)	176 (16%)	82 (7%)
September	1,270	-14 (-1%)	-15 (-1%)	-16 (-1%)	-6 (0%)	1,130	7 (1%)	30 (3%)	37 (3%)	39 (3%)
Total (TAF)	844	0 (0%)	-4 (0%)	12 (1%)	0 (0%)	760	10 (1%)	15 (2%)	49 (6%)	31 (4%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)

Notes: Simulation period: 1922-2003
Dry and critical years as defined by the Sacramento Valley Index
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
CVP = Central Valley Project
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

When evaluating project effects on water supply reliability, CVP south-of-Delta allocations are a valuable indicator of benefits resulting from each alternative. Tables 6-25 and 6-26 show the simulated annual allocations to south-of-Delta agricultural and M&I refuges and water service contractors for the existing condition and the No-Action Alternative, and the simulated change in allocation for each of the SLWRI alternatives. Simulated allocations are calculated by dividing annual deliveries of each contract type by the demand. The contract period for CVP allocations is assumed to be March through February; the assumed simulated demand for each contract type is as follows:

- **Agricultural water service contractors –** 1,987.2 TAF/year (both 2005 and 2030 level of development)
- **M&I water service contractors –** 164.2 TAF/year (both 2005 and 2030 level of development)
- **Federal refuges –** 304.6 TAF/year (2005 level of development)/281.1 TAF/year (2030 level of development)

Tables 6-25 and 6-26 show that although allocations would typically increase, years with small decreases in allocations could occur. More important than the average annual change in allocation is the increase in allocation in years with low allocations under either the existing condition or No-Action Alternative, such as in 1928, 1944, and 1976. Some decreases in allocations would occur during years in the latter parts of prolonged droughts. This likely is because of changes in CalSim-II north-of-Delta reservoir storage and water supply relationships.

Table 6-25. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2005 Level of Development

Year	Existing Conditions (2005)			Change from Existing Conditions											
				Alt CP1 and CP4 (2005)			Alt CP2 (2005)			Alt CP3 (2005)			Alt CP5 (2005)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
1922	79%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1923	42%	100%	67%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%
1924	16%	75%	61%	-2%	0%	-2%	-2%	0%	-2%	-2%	0%	-2%	-5%	0%	-5%
1925	38%	100%	67%	-2%	0%	0%	-2%	0%	0%	-2%	0%	0%	2%	0%	0%
1926	20%	100%	64%	2%	0%	2%	-2%	0%	-2%	-3%	0%	-3%	-7%	0%	-7%
1927	48%	100%	69%	-1%	0%	-1%	1%	0%	1%	1%	0%	1%	2%	0%	2%
1928	42%	100%	67%	3%	0%	0%	3%	0%	0%	3%	0%	0%	3%	0%	0%
1929	0%	100%	45%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%	0%
1930	25%	100%	67%	3%	0%	0%	-4%	0%	-2%	1%	0%	0%	2%	0%	0%
1931	14%	75%	58%	-1%	0%	-1%	0%	0%	0%	1%	0%	1%	0%	0%	0%
1932	22%	75%	67%	-4%	0%	-4%	-4%	0%	-4%	-3%	0%	-2%	-6%	0%	-6%
1933	9%	75%	54%	0%	0%	0%	1%	0%	1%	0%	0%	0%	1%	0%	1%
1934	16%	75%	61%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%	-1%	0%	-1%
1935	24%	100%	64%	-1%	0%	0%	-5%	0%	-1%	-5%	0%	-1%	-5%	0%	-1%
1936	41%	100%	67%	0%	0%	0%	3%	0%	0%	6%	0%	1%	1%	0%	0%
1937	31%	100%	66%	-1%	0%	0%	1%	0%	0%	2%	0%	0%	0%	0%	0%
1938	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1939	35%	98%	66%	0%	2%	-4%	0%	2%	-6%	-1%	0%	-6%	-1%	2%	-6%
1940	35%	100%	67%	1%	0%	0%	2%	0%	0%	3%	0%	0%	2%	0%	0%
1941	73%	100%	88%	1%	0%	0%	1%	0%	0%	1%	0%	0%	1%	0%	0%
1942	74%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1943	77%	100%	90%	4%	0%	0%	4%	0%	0%	4%	0%	0%	4%	0%	0%
1944	28%	100%	67%	1%	0%	0%	0%	0%	0%	3%	0%	0%	3%	0%	0%
1945	57%	100%	77%	-4%	0%	-3%	-4%	0%	-3%	0%	0%	0%	-4%	0%	-3%
1946	54%	100%	75%	3%	0%	3%	3%	0%	3%	1%	0%	1%	3%	0%	3%
1947	41%	100%	66%	-1%	0%	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%
1948	23%	100%	67%	-2%	0%	-2%	-1%	0%	-1%	7%	0%	0%	3%	0%	0%
1949	53%	100%	75%	0%	0%	0%	0%	0%	0%	-1%	0%	-2%	0%	0%	-1%
1950	34%	100%	67%	3%	0%	0%	2%	0%	0%	5%	0%	0%	5%	0%	0%
1951	57%	100%	78%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1952	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1953	36%	100%	67%	2%	0%	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%
1954	36%	100%	65%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1955	43%	100%	66%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1956	73%	100%	88%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1957	25%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1958	89%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1959	29%	100%	67%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%
1960	30%	100%	61%	2%	0%	0%	3%	-2%	0%	6%	0%	6%	3%	-2%	0%
1961	36%	100%	61%	-5%	-2%	-1%	-6%	-2%	-1%	-5%	0%	-1%	-6%	0%	-1%
1962	43%	100%	67%	2%	0%	0%	3%	0%	0%	2%	0%	0%	3%	0%	0%
1963	43%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1964	41%	100%	66%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%
1965	62%	100%	77%	0%	0%	-1%	0%	0%	-1%	0%	0%	0%	-1%	0%	0%
1966	39%	100%	67%	1%	0%	0%	1%	0%	0%	1%	0%	0%	1%	0%	0%
1967	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1968	32%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1969	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 6-25. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2005 Level of Development (contd.)

Year	Existing Conditions (2005)			Change from Existing Conditions											
				Alt CP1 and CP4 (2005)			Alt CP2 (2005)			Alt CP3 (2005)			Alt CP5 (2005)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
1970	**57%**	**100%**	**77%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
1971	32%	100%	67%	2%	0%	0%	5%	0%	0%	7%	0%	0%	7%	0%	0%
1972	37%	100%	67%	0%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%
1973	50%	100%	71%	4%	0%	3%	4%	0%	3%	4%	0%	3%	4%	0%	3%
1974	76%	100%	88%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1975	54%	100%	75%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1976	15%	100%	60%	4%	0%	3%	2%	0%	2%	7%	0%	7%	6%	0%	6%
1977	11%	75%	56%	0%	0%	0%	1%	0%	1%	1%	0%	1%	2%	0%	2%
1978	83%	100%	89%	4%	0%	0%	7%	0%	0%	8%	0%	1%	2%	0%	0%
1979	51%	100%	72%	-1%	0%	-1%	-2%	0%	-1%	-2%	0%	-1%	0%	0%	0%
1980	81%	99%	88%	4%	-11%	-10%	4%	-11%	-10%	4%	-11%	-10%	4%	-11%	-10%
1981	32%	100%	67%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%
1982	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1983	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1984	58%	100%	78%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1985	43%	100%	67%	2%	0%	-1%	2%	0%	-1%	2%	0%	0%	2%	0%	-6%
1986	63%	100%	83%	2%	0%	2%	6%	0%	6%	21%	0%	7%	16%	0%	7%
1987	25%	100%	66%	2%	0%	0%	1%	0%	0%	0%	0%	0%	1%	0%	0%
1988	0%	100%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1989	28%	99%	58%	0%	1%	3%	-1%	-1%	7%	0%	1%	6%	-2%	1%	6%
1990	0%	100%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1991	20%	75%	64%	-1%	0%	-1%	-1%	-2%	-11%	0%	0%	0%	-1%	0%	-12%
1992	22%	74%	61%	-2%	-3%	-7%	0%	0%	1%	0%	-6%	-6%	-1%	1%	5%
1993	50%	100%	73%	2%	0%	2%	1%	0%	1%	1%	0%	1%	0%	0%	-1%
1994	49%	75%	64%	-2%	0%	0%	-2%	0%	0%	0%	0%	0%	-3%	0%	0%
1995	88%	100%	90%	2%	0%	0%	3%	0%	0%	4%	0%	0%	4%	0%	0%
1996	62%	100%	83%	0%	0%	0%	-1%	0%	-1%	-1%	0%	-1%	-1%	0%	-1%
1997	66%	98%	81%	0%	2%	-2%	1%	2%	7%	1%	2%	7%	1%	0%	9%
1998	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1999	48%	100%	70%	3%	0%	2%	5%	0%	4%	6%	0%	6%	6%	0%	6%
2000	48%	100%	69%	0%	0%	0%	-1%	0%	-1%	-1%	0%	-1%	-1%	0%	-1%
2001	38%	100%	67%	2%	0%	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%
2002	32%	100%	67%	-1%	0%	0%	1%	0%	0%	2%	0%	0%	0%	0%	0%
2003	36%	50%	43%	0%	0%	0%	-1%	0%	0%	-1%	0%	0%	-2%	0%	0%
Av	46%	97%	71%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 simulations (Nodes DEL_CVP_PAG_S, DEL_CVP_PRF_S, and DEL_CVP_PMI_S for delivery information, and Common Assumptions Common Model Package Version 8D Delivery Specifications for demand information)

Notes:

Simulation period: 1922-2003

(%) indicates change from either existing condition or No-Action Alternative

Key:

Ag = Agricultural Water Service Contractor

Alt = alternative

Avg = average

M&I = municipal and industrial contractor

Ref = refuge

Refuge = Level 2 Federal Refuge

SLWRI = Shasta Lake Water Resources Investigation

Table 6-26. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2030 Level of Development

Year	No-Action/ No Project Alternative (2030)			Change from No-Action/ No Project Alternative											
				Alt CP1 and CP4 (2030)			Alt CP2 (2030)			Alt CP3 (2030)			Alt CP5 (2030)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
1922	80%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1923	41%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1924	8%	75%	53%	0%	0%	0%	-1%	0%	-1%	2%	0%	2%	-1%	0%	-1%
1925	46%	100%	68%	0%	0%	0%	-2%	0%	-1%	-2%	0%	-1%	-2%	0%	-1%
1926	17%	100%	61%	-4%	0%	-4%	-8%	0%	-8%	-7%	0%	-7%	-9%	0%	-10%
1927	50%	100%	71%	1%	0%	1%	2%	0%	2%	2%	0%	2%	-1%	0%	-1%
1928	38%	100%	67%	5%	0%	0%	6%	0%	0%	10%	0%	2%	11%	0%	3%
1929	0%	100%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1930	16%	100%	60%	-3%	0%	-3%	-2%	0%	-2%	0%	0%	0%	2%	0%	1%
1931	9%	75%	53%	1%	0%	1%	0%	0%	0%	3%	0%	3%	0%	0%	0%
1932	15%	75%	59%	0%	0%	0%	0%	0%	0%	4%	0%	4%	-1%	0%	-1%
1933	4%	75%	49%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%
1934	9%	75%	54%	1%	0%	1%	-1%	0%	-1%	2%	0%	2%	1%	0%	1%
1935	21%	100%	63%	-4%	0%	-4%	-7%	0%	-6%	-6%	0%	-5%	-5%	0%	-4%
1936	36%	100%	67%	4%	0%	0%	1%	0%	0%	5%	0%	0%	1%	0%	0%
1937	30%	100%	66%	-2%	0%	0%	-3%	0%	-1%	-2%	0%	-1%	0%	0%	0%
1938	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1939	30%	98%	61%	2%	0%	0%	4%	0%	-1%	3%	0%	-1%	4%	0%	-1%
1940	42%	100%	67%	-3%	0%	0%	-3%	0%	0%	0%	0%	0%	-3%	0%	0%
1941	72%	100%	89%	4%	0%	0%	4%	0%	1%	4%	0%	1%	4%	0%	1%
1942	78%	100%	88%	-1%	0%	2%	-1%	0%	2%	-1%	0%	2%	-1%	0%	2%
1943	72%	100%	90%	7%	0%	0%	9%	0%	-2%	9%	0%	-2%	9%	0%	-2%
1944	23%	100%	67%	-3%	0%	-3%	-1%	0%	-1%	4%	0%	0%	3%	0%	0%
1945	57%	100%	78%	-5%	0%	-4%	-6%	0%	-5%	-1%	0%	-1%	-8%	0%	-7%
1946	57%	100%	78%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1947	37%	100%	67%	6%	0%	0%	8%	0%	0%	9%	0%	1%	9%	0%	1%

Table 6-26. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2030 Level of Development (contd.)

Year	No-Action/ No Project Alternative (2030)			Change from No-Action/ No Project Alternative											
				Alt CP1 and CP4 (2030)			Alt CP2 (2030)			Alt CP3 (2030)			Alt CP5 (2030)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
1948	27%	100%	66%	-5%	0%	0%	-6%	0%	-1%	0%	0%	0%	-4%	0%	0%
1949	52%	100%	74%	1%	0%	1%	1%	0%	1%	0%	0%	-1%	1%	0%	0%
1950	27%	100%	67%	1%	0%	0%	1%	0%	0%	11%	0%	0%	3%	0%	0%
1951	58%	100%	79%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1952	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1953	39%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1954	39%	100%	66%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1955	33%	100%	67%	6%	0%	0%	10%	0%	0%	12%	0%	-1%	12%	0%	-1%
1956	75%	100%	88%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1957	28%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1958	91%	100%	90%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%
1959	31%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1960	25%	98%	60%	3%	0%	0%	4%	0%	0%	9%	2%	-1%	7%	0%	-1%
1961	36%	98%	60%	-2%	1%	0%	-2%	1%	0%	-6%	2%	0%	-3%	2%	0%
1962	42%	100%	67%	2%	0%	0%	2%	0%	0%	3%	0%	0%	3%	0%	0%
1963	45%	100%	67%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%
1964	37%	100%	67%	3%	0%	0%	9%	0%	0%	15%	0%	5%	15%	0%	5%
1965	67%	100%	84%	-1%	0%	0%	-1%	0%	0%	-3%	0%	-4%	-2%	0%	0%
1966	38%	100%	67%	-1%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%
1967	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1968	34%	100%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1969	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1970	57%	100%	77%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1971	32%	100%	67%	2%	0%	0%	4%	0%	0%	6%	0%	0%	6%	0%	0%
1972	38%	100%	67%	0%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%
1973	51%	100%	72%	5%	0%	5%	5%	0%	5%	5%	0%	5%	5%	0%	5%

Table 6-26. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2030 Level of Development (contd.)

Year	No-Action/ No Project Alternative (2030)			Change from No-Action/ No Project Alternative											
				Alt CP1 and CP4 (2030)			Alt CP2 (2030)			Alt CP3 (2030)			Alt CP5 (2030)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
1974	75%	100%	88%	2%	0%	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%
1975	55%	100%	76%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%	0%	0%	-1%
1976	9%	100%	54%	-1%	0%	-1%	2%	0%	2%	7%	0%	7%	7%	0%	6%
1977	6%	75%	51%	0%	0%	0%	0%	0%	0%	2%	0%	2%	0%	0%	0%
1978	89%	100%	89%	2%	0%	1%	2%	0%	1%	3%	0%	1%	2%	0%	1%
1979	49%	100%	71%	1%	0%	1%	1%	0%	1%	1%	0%	1%	1%	0%	1%
1980	75%	100%	90%	10%	0%	0%	14%	0%	0%	14%	0%	0%	14%	0%	0%
1981	37%	100%	66%	-2%	0%	0%	-4%	0%	1%	-4%	0%	1%	-4%	0%	1%
1982	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1983	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1984	58%	100%	79%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1985	49%	100%	70%	0%	0%	0%	3%	0%	2%	3%	0%	2%	3%	0%	2%
1986	57%	100%	77%	2%	0%	2%	8%	0%	7%	21%	0%	12%	17%	0%	12%
1987	21%	100%	64%	2%	0%	1%	0%	0%	-1%	-1%	0%	-1%	-1%	0%	-1%
1988	0%	100%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1989	27%	100%	65%	-3%	0%	0%	-5%	0%	0%	-2%	0%	0%	-4%	0%	0%
1990	0%	100%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1991	12%	73%	47%	2%	2%	8%	1%	2%	11%	2%	2%	11%	1%	1%	-1%
1992	19%	66%	56%	0%	0%	0%	-4%	8%	3%	4%	1%	3%	-5%	8%	0%
1993	54%	100%	76%	0%	0%	0%	1%	0%	1%	-1%	0%	-1%	1%	0%	1%
1994	44%	73%	64%	0%	1%	0%	0%	0%	0%	1%	2%	0%	0%	2%	0%
1995	86%	100%	90%	6%	0%	0%	6%	0%	0%	6%	0%	0%	3%	0%	0%
1996	63%	100%	85%	-1%	0%	-1%	-1%	0%	-1%	-1%	0%	-1%	-1%	0%	0%
1997	69%	100%	89%	2%	0%	-1%	2%	0%	-1%	2%	0%	-1%	2%	0%	-1%
1998	92%	100%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1999	49%	100%	71%	1%	0%	1%	5%	0%	4%	5%	0%	5%	5%	0%	5%

Table 6-26. Simulated Annual Delivery Allocations to South-of-Delta CVP Water Service Contractors and Refuges for a 2030 Level of Development (contd.)

Year	No-Action/ No Project Alternative (2030)			Change from No-Action/ No Project Alternative											
				Alt CP1 and CP4 (2030)			Alt CP2 (2030)			Alt CP3 (2030)			Alt CP5 (2030)		
	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I	Ag	Ref	M&I
2000	48%	100%	70%	0%	0%	0%	-1%	0%	-1%	-1%	0%	-1%	-1%	0%	-1%
2001	32%	100%	67%	4%	0%	0%	7%	0%	0%	8%	0%	0%	9%	0%	0%
2002	35%	100%	67%	-2%	0%	0%	-1%	0%	0%	1%	0%	0%	-2%	0%	0%
2003	37%	50%	43%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	-2%	0%	0%
Avg	45%	96%	71%	1%	0%	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%

Source: SLWRI 2012 Benchmark Version CalSim-II 2030 simulations (Nodes DEL_CVP_PAG_S, DEL_CVP_PRF_S, and DEL_CVP_PMI_S for delivery information, and Common Assumptions Common Model Package Version 8D Delivery Specifications for demand information)

Notes:

Simulation period: 1922-2003

(%) indicates change from either existing condition or No-Action Alternative

Key:

Ag = agricultural water service contractor

Alt = alternative

Avg = average

M&I = municipal and industrial contractor

Ref = Level 2 Federal Refuge

SLWRI = Shasta Lake Water Resources Investigation

The Banks Pumping Plant provides water supply to SWP contractors, and when capacity is available may also export CVP water to support CVP deliveries. CP1, CP2, CP4 and CP5 all include reserving a portion of the increased storage capacity in Shasta Reservoir to specifically focus on increasing M&I deliveries. For this DEIS, these operations were simulated in CalSim-II by using the reserved storage capacity to provide deliveries for previously unmet SWP demands during dry and critical years. These additional water supplies for SWP deliveries are pumped through Banks Pumping Plant. Table 6-27 shows average annual exports through Banks Pumping Plant for the various SLWRI alternatives.

Table 6-27. Simulated Monthly Average Exports Through the Banks Pumping Plant

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	3,308	46 (1%)	69 (2%)	26 (1%)	92 (3%)	3,156	71 (2%)	87 (3%)	37 (1%)	127 (4%)
November	3,155	64 (2%)	89 (3%)	57 (2%)	88 (3%)	3,222	17 (1%)	50 (2%)	43 (1%)	63 (2%)
December	4,892	-1 (0%)	7 (0%)	-4 (0%)	12 (0%)	4,949	-1 (0%)	-37 (-1%)	-59 (-1%)	-35 (-1%)
January	3,556	-9 (0%)	-48 (-1%)	9 (0%)	-64 (-2%)	3,589	-1 (0%)	9 (0%)	7 (0%)	5 (0%)
February	3,960	-2 (0%)	4 (0%)	10 (0%)	-5 (0%)	4,073	0 (0%)	-22 (-1%)	-12 (0%)	-34 (-1%)
March	3,936	11 (0%)	-5 (0%)	25 (1%)	14 (0%)	3,958	31 (1%)	21 (1%)	5 (0%)	16 (0%)
April	1,065	0 (0%)	1 (0%)	-3 (0%)	-1 (0%)	1,240	0 (0%)	-2 (0%)	-2 (0%)	-6 (0%)
May	1,099	1 (0%)	2 (0%)	-1 (0%)	0 (0%)	1,133	4 (0%)	6 (1%)	-13 (-1%)	6 (1%)
June	2,526	3 (0%)	6 (0%)	7 (0%)	17 (1%)	2,550	8 (0%)	14 (1%)	31 (1%)	23 (1%)
July	6,435	6 (0%)	15 (0%)	-30 (0%)	26 (0%)	6,274	53 (1%)	109 (2%)	34 (1%)	136 (2%)
August	5,597	85 (2%)	141 (3%)	-25 (0%)	169 (3%)	5,603	23 (0%)	57 (1%)	-71 (-1%)	85 (2%)
September	5,242	70 (1%)	107 (2%)	-19 (0%)	102 (2%)	5,449	86 (2%)	150 (3%)	2 (0%)	141 (3%)
Total (TAF)	2,706	17 (1%)	23 (1%)	3 (0%)	27 (1%)	2,730	18 (1%)	27 (1%)	0 (0%)	32 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node D419)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No–Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Tables 6-28 and 6-29 show the mean monthly delivery to SWP contractors south of the Delta for all years and for dry and critical years respectively.

Table 6-28. Simulated Monthly Average Deliveries to SWP Table A Contractors

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	3,226	1 (0%)	-7 (0%)	-25 (-1%)	-8 (0%)	3,351	17 (1%)	44 (1%)	-9 (0%)	57 (2%)
November	2,689	35 (1%)	51 (2%)	4 (0%)	79 (3%)	2,812	1 (0%)	18 (1%)	1 (0%)	32 (1%)
December	2,476	28 (1%)	33 (1%)	4 (0%)	19 (1%)	2,886	28 (1%)	38 (1%)	-1 (0%)	49 (2%)
January	623	9 (2%)	18 (3%)	-6 (-1%)	22 (4%)	988	31 (3%)	49 (5%)	-20 (-2%)	55 (6%)
February	1,106	21 (2%)	32 (3%)	-6 (-1%)	36 (3%)	1,860	27 (1%)	52 (3%)	-13 (-1%)	59 (3%)
March	1,804	18 (1%)	28 (2%)	-6 (0%)	27 (1%)	2,307	14 (1%)	27 (1%)	-9 (0%)	30 (1%)
April	4,733	18 (0%)	24 (1%)	1 (0%)	17 (0%)	5,094	27 (1%)	35 (1%)	2 (0%)	40 (1%)
May	5,837	33 (1%)	43 (1%)	17 (0%)	47 (1%)	6,335	23 (0%)	31 (0%)	5 (0%)	36 (1%)
June	7,433	-7 (0%)	-22 (0%)	22 (0%)	7 (0%)	7,612	38 (1%)	41 (1%)	-8 (0%)	33 (0%)
July	7,841	41 (1%)	49 (1%)	-6 (0%)	55 (1%)	8,147	12 (0%)	31 (0%)	-31 (0%)	27 (0%)
August	7,017	14 (0%)	12 (0%)	-25 (0%)	21 (0%)	7,244	-12 (0%)	-13 (0%)	-54 (-1%)	-20 (0%)
September	5,086	22 (0%)	47 (1%)	-4 (0%)	54 (1%)	5,322	37 (1%)	52 (1%)	4 (0%)	71 (1%)
Total (TAF)	3,020	14 (0%)	19 (1%)	-2 (0%)	23 (1%)	3,265	15 (0%)	24 (1%)	-8 (0%)	28 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
SWP = State Water Project
TAF = thousand acre-feet

Table 6-29. Simulated Monthly Average Deliveries to SWP Table A Contractors in Dry and Critical Years

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
Oct	2,873	50 (2%)	63 (2%)	8 (0%)	73 (3%)	3,051	32 (1%)	50 (2%)	-13 (0%)	64 (2%)
Nov	2,282	54 (2%)	71 (3%)	6 (0%)	83 (4%)	2,342	2 (0%)	28 (1%)	1 (0%)	33 (1%)
Dec	2,014	82 (4%)	89 (4%)	12 (1%)	76 (4%)	2,392	71 (3%)	78 (3%)	38 (2%)	90 (4%)
Jan	389	-3 (-1%)	0 (0%)	-5 (-1%)	2 (1%)	412	13 (3%)	28 (7%)	-18 (-4%)	32 (8%)
Feb	637	29 (5%)	47 (7%)	-10 (-2%)	48 (8%)	766	21 (3%)	45 (6%)	-25 (-3%)	49 (6%)
Mar	1,041	31 (3%)	56 (5%)	-14 (-1%)	57 (5%)	1,101	30 (3%)	60 (5%)	-31 (-3%)	73 (7%)
Apr	4,156	48 (1%)	69 (2%)	-9 (0%)	47 (1%)	4,251	74 (2%)	102 (2%)	-25 (-1%)	109 (3%)
May	4,983	19 (0%)	55 (1%)	-14 (0%)	60 (1%)	5,143	72 (1%)	103 (2%)	-22 (0%)	118 (2%)
Jun	6,408	-48 (-1%)	-66 (-1%)	-11 (0%)	-24 (0%)	6,471	46 (1%)	61 (1%)	-87 (-1%)	44 (1%)
Jul	6,757	110 (2%)	146 (2%)	-9 (0%)	166 (2%)	6,933	64 (1%)	133 (2%)	-56 (-1%)	126 (2%)
Aug	5,605	45 (1%)	45 (1%)	-58 (-1%)	80 (1%)	5,679	10 (0%)	16 (0%)	-132 (-2%)	2 (0%)
Sep	4,003	62 (2%)	140 (3%)	-8 (0%)	161 (4%)	4,066	119 (3%)	175 (4%)	3 (0%)	225 (6%)
Total (TAF)	2,493	29 (1%)	43 (2%)	-7 (0%)	50 (2%)	2,581	34 (1%)	53 (2%)	-22 (-1%)	58 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Dry and critical years as defined by the Sacramento Valley Index

Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
SWP = State Water Project
TAF = thousand acre-feet

Changes in Delta export operations could potentially also result in changes in reservoir operations south of the Delta along the San Joaquin River due to changes in return flows from project deliveries. These changes, if they occur, would be expected to be very small. Any changes in operations of San Joaquin River basin reservoirs would be reflected in changes in San Joaquin River flows near its confluence with the Delta. The San Joaquin River at Vernalis is commonly used as the downstream end of the San Joaquin River. Table 6-30 shows simulated San Joaquin River flow at Vernalis. According to modeling, the SLWRI alternatives do not affect San Joaquin River flows at Vernalis.

Table 6-30. Simulated Monthly Average San Joaquin River Flows at Vernalis

Month	Existing Condition (2005)					Future Condition (2030)				
	Existing Condition (cfs)	Change from Base				No-Action Alt (cfs)	Change from Base			
		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)		CP1 and CP4 (cfs)	CP2 (cfs)	CP3 (cfs)	CP5 (cfs)
October	2,757	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,753	0 (0%)	0 (0%)	0 (0%)	0 (0%)
November	2,633	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,603	0 (0%)	0 (0%)	0 (0%)	0 (0%)
December	3,199	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3,263	0 (0%)	0 (0%)	0 (0%)	0 (0%)
January	4,770	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4,764	0 (0%)	0 (0%)	0 (0%)	0 (0%)
February	6,265	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6,143	0 (0%)	0 (0%)	0 (0%)	0 (0%)
March	7,133	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7,003	0 (0%)	0 (0%)	0 (0%)	0 (0%)
April	6,720	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7,533	0 (0%)	0 (0%)	0 (0%)	0 (0%)
May	6,204	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6,234	0 (0%)	0 (0%)	0 (0%)	0 (0%)
June	4,739	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4,671	0 (0%)	0 (0%)	0 (0%)	0 (0%)
July	3,202	0 (0%)	0 (0%)	1 (0%)	0 (0%)	3,208	0 (0%)	0 (0%)	1 (0%)	1 (0%)
August	2,029	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,040	0 (0%)	0 (0%)	1 (0%)	0 (0%)
September	2,331	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,340	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total (TAF)	3,126	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3,161	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (NodesC639)

Notes:
Simulation period: 1922-2003
(%) indicates percent change from either existing condition or No-Action Alternative
Key:
Alt = alternative
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
SWP = State Water Project
TAF = thousand acre-feet

No-Action Alternative

For a complete list of the differences between the No-Action Alternative and the existing conditions, see Table 2-1 in the Modeling Appendix.

As described above, modeling indicates that the No-Action Alternative would continue to meet water supply demands at levels of compliance similar to the existing conditions and would not result in any appreciable changes in water supply reliability.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact H&H-1 (No-Action): Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge Flood management operations would not change under the No-Action Alternative as compared to the existing condition, the recurrence of flows above 100,000 cfs on the Sacramento River below Bend Bridge would remain the same as the existing condition. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact H&H-2 (No-Action): Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map No new structures would be built in the flood plain under the No-Action Alternative, and flood management operations at Shasta Dam would not change under the No-Action Alternative as compared to the existing condition. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact H&H-3(No-Action): Place within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows No new structures would be built in the flood plain under the No-Action Alternative, and flood management operations at Shasta Dam would not change under the No-Action Alternative. No impact would occur. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta

Impact H&H-4 (No-Action): Change in Water Levels in the Old River near Tracy Road Bridge Water levels in the Old River near Tracy Road Bridge could be slightly lower under the No-Action Alternative than the existing condition. This impact would be less than significant.

As shown in Table 6-31, maximum monthly reductions in minimum daily water level associated with No-Action compared to the existing conditions would exceed -0.1 feet; however, the reductions would not result in water levels less than 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 6-31. Simulated Monthly Maximum 15-Minute Change in Water Levels at Various Locations in the South Delta at Low-Low Tide

Month	Change from Existing Condition		
	Old River near Tracy Road Bridge (feet)	Grant Line Canal near the Grant Line Canal Barrier (feet)	Middle River near the Howard Road Bridge (feet)
April	-0.02 (0%)	-0.02 (0%)	-0.02 (0%)
May	-0.27 (0%)	-0.37 (0%)	-0.29 (0%)
June	-0.42 (0%)	-0.48 (0%)	-0.45 (0%)
July	-0.05 (0%)	-0.04 (0%)	-0.05 (0%)
August	-0.05 (0%)	-0.02 (0%)	-0.05 (0%)
September	-0.19 (0%)	-0.08 (0%)	-0.21 (0%)
October	-0.08 (0%)	-0.03 (0%)	-0.08 (0%)

Source: Version8.0.6 DSM2 2005 and 2030 simulations (Node 071_3116, Node 129_5691, and Node 206_5533)

Notes:
Simulation period: 1922-2003
(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Impact H&H-5 (No-Action): Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier Water levels in the Grant Line Canal near the Grant Line Canal Barrier could be slightly lower under the No-Action Alternative than the existing condition. This impact would be less than significant.

As shown in Table 6-31, maximum monthly reductions in minimum daily water level associated with No-Action compared to the existing conditions would exceed -0.1 feet; however, the reductions would not result in water levels less than 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact H&H-6 (No-Action): Change in Water Levels in the Middle River near the Howard Road Bridge Water levels in the Middle River near the Howard Road Bridge could be slightly lower under the No-Action Alternative than the existing condition. This impact would be less than significant.

As shown in Table 6-31, maximum monthly reductions in minimum daily water level associated with No-Action compared to the existing conditions would exceed -0.1 feet; however, the reductions would not result in water levels less than 0.3 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact H&H-7 (No-Action): Change in X2 Position The X2 Position would not change from west to east of Collinsville in December or January when the Delta would not be in balanced conditions. Examination of simulation output indicates that compared to the existing condition, in no months would the No-Action Alternative cause the X2 position to shift from west to east of Collinsville, when the Delta would not be in balanced conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact H&H-8 (No-Action): Change in Recurrence of Delta Excess Conditions Few changes would occur from excess to balanced Delta conditions under the No-Action Alternative. This impact would be less than significant.

As shown in Table 6-32, CP1 would cause the Delta to change from excess to balanced conditions 16 times in the simulation: however, no month would change more than 5 percent of the time and at most only once during the 83-year period, according to the simulation. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 6-32. Simulated Number of Years the Delta Changes from Excess to Balanced Condition

Number of Years the Delta Changes from Excess to Balanced Conditions Compared to Existing Condition											
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
0 (0%)	0 (0%)	1 (1%)	1 (1%)	1 (1%)	3 (4%)	1 (1%)	3 (4%)	1 (1%)	0 (0%)	4 (5%)	1 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations
Notes:
Simulation Period: 1922-2003
Number in parentheses indicates percentage of months Delta condition change occurs
Key:
SLWRI = Shasta Lake Water Resources Investigation

CVP/SWP Service Areas

Impact H&H-9 (No-Action): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries to north-of-Delta CVP water service contractors and refuges would be greater under the No-Action Alternative relative to the existing condition, which would be beneficial, but decreases would occur in certain months. This impact would be potentially significant.

As shown in Table 6-33, average annual deliveries to north-of-Delta CVP water service contractors and refuges under the No-Action Alterative would be greater than under existing conditions, which would be beneficial, and less than 5 percent less in dry and critical years. April deliveries would decrease by 10 percent in all years, and April, May and June deliveries would decrease by 18, 10, and 10 percent in dry and critical years, respectively. This impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Table 6-33. Simulated Monthly Average Deliveries and Percent Change of Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Change from Existing Conditions	
	Average All Years (cfs (%))	Dry and Critical Years (cfs (%))
October	43 (17%)	24 (10%)
November	51 (30%)	56 (36%)
December	28 (27%)	28 (27%)
January	13 (26%)	13 (26%)
February	11 (23%)	10 (19%)
March	-1 (-4%)	-4 (-12%)
April	-34 (-10%)	-45 (-18%)
May	-3 (-1%)	-35 (-10%)
June	6 (1%)	-49 (-10%)
July	21 (2%)	-38 (-7%)
August	31 (4%)	-22 (-4%)
September	44 (8%)	23 (6%)
Total (TAF)	13 (4%)	-2 (-1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index

Key:

cfs = cubic feet per second

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-10 (No-Action): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries to south-of-Delta CVP water service contractors and refuges would decrease by more than 10 percent in dry and critical years under the No-Action Alternative, relative to the existing condition. This impact would be potentially significant.

As shown in Table 6-34, annual deliveries to south-of-Delta CVP water service contractors and refuges would decrease by 3 and 10 percent in average annual and dry and critical years, respectively. This impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Table 6-34. Simulated Monthly Average Deliveries and Percent Change of Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Change from Existing Conditions	
	Average All Years (cfs (%))	Dry and Critical Years (cfs (%))
October	-95 (-6%)	-104 (-7%)
November	-66 (-6%)	-73 (-7%)
December	-41 (-5%)	-51 (-7%)
January	-30 (-3%)	-47 (-6%)
February	-31 (-3%)	-53 (-6%)
March	-31 (-4%)	-66 (-15%)
April	-42 (-3%)	-97 (-12%)
May	-73 (-4%)	-144 (-11%)
June	-87 (-3%)	-192 (-10%)
July	-81 (-2%)	-235 (-12%)
August	-31 (-1%)	-196 (-15%)
September	-89 (-6%)	-141 (-11%)
Total (TAF)	-42 (-3%)	-85 (-10%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index

Key:

cfs = cubic feet per second

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-11 (No-Action): Change in Deliveries to SWP Table A Contractors Average deliveries to SWP Table A contractors would increase under the No-Action Alternative relative to the existing condition. This impact would be beneficial.

As shown in Table 6-35, average annual and monthly deliveries to SWP Table A contractors would increase under the No-Action Alternative relative to existing conditions for the average of all years, and for dry and critical years. This impact would be beneficial. Mitigation is not required for the No-Action Alternative.

Table 6-35. Simulated Monthly Average Deliveries and Percent Change of Deliveries to SWP Table A Contractors

Month	Change from Existing Conditions	
	Average All Years (cfs (%))	Dry and Critical Years (cfs (%))
October	125 (4%)	178 (6%)
November	123 (5%)	60 (3%)
December	410 (17%)	378 (19%)
January	365 (59%)	22 (6%)
February	753 (68%)	129 (20%)
March	503 (28%)	60 (6%)
April	361 (8%)	96 (2%)
May	498 (9%)	160 (3%)
June	179 (2%)	63 (1%)
July	306 (4%)	177 (3%)
August	226 (3%)	73 (1%)
September	236 (5%)	63 (2%)
Total (TAF)	245 (8%)	88 (4%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index

Key:

cfs = cubic feet per second

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-12(No-Action): Change in Groundwater Changes in groundwater levels would not be measurable under the No-Action Alternative as compared to the existing condition. This impact would be less than significant.

As shown in Tables 6-33, 6-34, and 6-35, total surface water deliveries to CVP and SWP contractors increase for the No-Action Alternative as compared to the existing condition. However, these increases in deliveries are likely associated with increases in demands rather than increases in water supply. Although groundwater pumping would still be required, the volume of pumping in the CVP/SWP service area would not be expected to change noticeably. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact H&H-13 (No-Action): Change in Groundwater Quality Changes in groundwater quality under the No-Action Alternative as compared to the existing condition would not be measurable. This impact would be less than significant.

As shown in Tables 6-11, 6-12, 6-23, 6-24, 6-28, and 6-29, total surface water deliveries to CVP and SWP contractors to increase for the No-Action Alternative compared to the existing condition. However, these increases in deliveries are likely associated with increases in demands rather than increases in water supply. Although groundwater pumping would still be required, the volume of pumping in the CVP/SWP service area would not be expected to change noticeably. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 primarily consists of raising Shasta Dam by 6.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 8.5 feet and enlarge the total storage capacity in the reservoir by 256,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 70 TAF and 35 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact H&H-1 (CP1): Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge Although flood management operations would not change under the CP1, a slight reduction could occur in the frequency of flows greater than 100,000 cfs. This impact would be beneficial.

SLWRI modeling uses a monthly time step, which is inappropriate for flood control analysis; however, flood management operations for downstream objectives would not change under CP1. Although a slight decrease in recurrence of high flows would be possible because of the increased storage capability, CP1 would not increase the frequency of flows above 100,000 cfs. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-2 (CP1): Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map No new structures would be built downstream from Shasta Dam. All project construction would be completed at the Shasta Dam site, and although the reservoir area would be expanded, any structures located within the reservoir area would be removed. Because reservoir operations for downstream objectives would not change, no additional structures downstream from the dam would be located within the 100-year flood hazard area. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-3 (CP1): Place within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows No new structures would be built downstream from Shasta Dam. All project construction would be done at the Shasta Dam site, and although the reservoir area would be expanded, any structures located within the reservoir area would be removed. Because reservoir operations for downstream objectives would not change, no additional structures downstream from the dam would be located within the 100-year flood hazard area that would impede or redirect flood flows. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact H&H-4 (CP1): Change in Water Levels in the Old River near Tracy Road Bridge Simulated water levels in the Old River near Tracy Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-36, maximum monthly reduction in minimum daily water level associated with CP1 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-36. Simulated Monthly Maximum 15-Minute Change in Old River Water Levels near Tracy Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP1 (2005) Change (feet)	CP1 (2030) Change (feet)
April	0 00 (0%)	-0.01 (0%)
May	-0.01 (0%)	-0.01 (0%)
June	0 00 (0%)	-0.05 (0%)
July	-0.05 (0%)	-0.03 (0%)
August	-0.04 (0%)	-0.05 (0%)
September	-0.04 (0%)	-0.06 (0%)
October	-0.05 (0%)	-0.05 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 071_3116)

Note:
Simulation period: 1922-2003
Key:
CP = comprehensive plan

Impact H&H-5 (CP1): Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier Simulated water levels in the Grant Line Canal near the Grant Line Canal Barrier show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-37, maximum monthly reduction in minimum daily water level associated with CP1 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-37. Simulated Monthly Maximum 15-Minute Change in the Grant Line Canal Water Levels near the Grant Line Canal Barrier at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP1 (2005) Change (feet)	CP1 (2030) Change (feet)
April	0.00 (0%)	0.00 (0%)
May	-0.01 (0%)	-0.01 (0%)
June	0.00 (0%)	-0.03 (0%)
July	-0.06 (0%)	-0.03 (0%)
August	-0.03 (0%)	-0.03 (0%)
September	-0.02 (0%)	-0.04 (0%)
October	-0.02 (0%)	-0.02 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 129_5691)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-6 (CP1): Change in Water Levels in the Middle River near the Howard Road Bridge Simulated water levels in the Middle River near the Howard Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-38, maximum monthly reduction in minimum daily water level associated with CP1 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action alternative. The water levels would remain above 0.3 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-38. Simulated Monthly Maximum 15-Minute Change in Middle River Water Levels near the Howard Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP1 (2005) Change (feet)	CP1 (2030) Change (feet)
April	0 00 (0%)	-0.01 (0%)
May	-0.01 (0%)	-0.01 (0%)
June	0 00 (0%)	-0.05 (0%)
July	-0.05 (0%)	-0.03 (0%)
August	-0.04 (0%)	-0.04 (0%)
September	-0.04 (0%)	-0.07 (0%)
October	-0.05 (0%)	-0.05 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 206_5533)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-7 (CP1): Change in X2 Position The X2 Position would not change from west to east of Collinsville in December or January when the Delta was not in balanced conditions. Examination of simulation output indicates that compared to the existing condition, or No-Action Alternative, CP1 shows no months when the X2 position to shifts from west to east of Collinsville when the Delta would not be in balanced conditions. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-8 (CP1): Change in Recurrence of Delta Excess Conditions Changes from excess to balance Delta conditions would be rare. This impact would be less than significant.

As shown in Table 6-39, CP1 would cause one April, one June, two Julys, three Augusts, one October, and one November to switch from excess to balanced Delta conditions when compared to the existing condition, and two Augusts, two Novembers, and one each of October and December when compared to the No-Action Alternative. Because of the low number of occurrences, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-39. Simulated Number of Years the Delta Changes from Excess to Balanced Condition

	Number of Years the Delta Changes from Excess to Balanced Conditions Compared to Existing Condition or No-Action Alternative											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CP1 (2005)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	1 (1%)	2 (2%)	3 (4%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)
CP1 (2030)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	2 (2%)	1 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations
Notes:
Simulation Period: 1922-2003
Number in parentheses indicates percentage of months Delta condition change occurs
Key:
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation

CVP/SWP Service Areas

Impact H&H-9 (CP1): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries would increase under all conditions. Average monthly deliveries would generally increase but could show small decreases in October and November of less than the significance criteria. This impact would be less than significant.

As shown in Table 6-40, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. Decreases of 3 and 9 percent average October delivery could occur under existing conditions when averaged over all years and dry and critical years respectively. Decreases of less than 1 and 2 percent average November delivery could occur under future conditions when averaged over all years and dry and critical years respectively. These decreases are less than the 10 percent decrease significance criteria. This impact is less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-40. Simulated Monthly Average Deliveries and Percent Change of Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP1 Change (cfs (%))	Existing Condition (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))
Oct	254	-7 (-3%)	251	-22 (-9%)	297	4 (1%)	275	10 (4%)
Nov	170	2 (1%)	159	5 (3%)	222	-1 (0%)	215	-4 (-2%)
Dec	105	0 (0%)	104	0 (0%)	133	0 (0%)	132	0 (0%)
Jan	50	0 (0%)	50	0 (0%)	63	0 (0%)	62	0 (0%)
Feb	48	0 (0%)	52	0 (0%)	59	0 (0%)	62	0 (0%)
Mar	32	1 (3%)	33	2 (7%)	31	1 (2%)	29	2 (5%)
Apr	350	12 (3%)	243	14 (6%)	316	13 (4%)	199	11 (5%)
May	622	14 (2%)	363	17 (5%)	619	15 (2%)	328	11 (3%)
Jun	878	18 (2%)	500	24 (5%)	884	20 (2%)	452	16 (3%)
Jul	1,024	20 (2%)	579	26 (4%)	1,044	19 (2%)	540	11 (2%)
Aug	876	17 (2%)	520	23 (4%)	907	18 (2%)	498	18 (4%)
Sep	527	8 (1%)	348	10 (3%)	572	8 (1%)	370	6 (2%)
Total (TAF)	299	5 (2%)	194	6 (3%)	312	6 (2%)	192	5 (3%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-10 (CP1): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges Average annual and monthly deliveries would increase under both existing and future conditions. This impact would be beneficial.

As shown in Table 6-41, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Table 6-41. Simulated Monthly Average Deliveries and Percent Change of Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP1 Change (cfs (%))	Existing Condition (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))
Oct	1,600	3 (0%)	1,473	6 (0%)	1,505	6 (0%)	1,369	8 (1%)
Nov	1,091	3 (0%)	996	4 (0%)	1,025	4 (0%)	923	6 (1%)
Dec	837	3 (0%)	715	6 (1%)	796	6 (1%)	664	8 (1%)
Jan	1,027	6 (1%)	818	10 (1%)	998	10 (1%)	771	14 (2%)
Feb	1,209	8 (1%)	948	13 (1%)	1,178	13 (1%)	895	18 (2%)
Mar	753	13 (2%)	451	15 (3%)	722	15 (2%)	385	6 (2%)
Apr	1,296	11 (1%)	834	-1 (0%)	1,254	15 (1%)	737	5 (1%)
May	2,009	11 (1%)	1,325	-2 (0%)	1,935	19 (1%)	1,181	11 (1%)
Jun	3,088	28 (1%)	1,935	23 (1%)	3,001	32 (1%)	1,743	19 (1%)
Jul	3,256	20 (1%)	1,923	-10 (-1%)	3,175	37 (1%)	1,688	19 (1%)
Aug	2,275	3 (0%)	1,296	-39 (-3%)	2,244	12 (1%)	1,100	38 (3%)
Sep	1,620	-10 (-1%)	1,270	-14 (-1%)	1,531	10 (1%)	1,130	7 (1%)
Total (TAF)	1,212	6 (0%)	844	0 (0%)	1,170	11 (1%)	760	10 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-11 (CP1): Change in Deliveries to SWP Table A Contractors
Average annual deliveries would increase under both existing and future conditions, but some less than significant decreases could occur in monthly deliveries under future conditions. This impact would be less than significant.

As shown in Table 6-42, average annual deliveries to SWP Table A contractors would increase under CP1 in both existing and future conditions relative to the bases of comparison in both average years and in dry and critical years. Under both existing and future conditions some decreases could occur in deliveries under CP1.These decreases would be less than 1 percent. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-42. Simulated Monthly Average Deliveries and Percent Change of Deliveries to SWP Table A Contractors

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP1 Change (cfs (%))	Existing Condition (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))	No-Action Alternative (cfs)	CP1 Change (cfs (%))
Oct	3,226	1 (0%)	2,873	50 (2%)	3,351	17 (1%)	3,051	32 (1%)
Nov	2,689	35 (1%)	2,282	54 (2%)	2,812	1 (0%)	2,342	2 (0%)
Dec	2,476	28 (1%)	2,014	82 (4%)	2,886	28 (1%)	2,392	71 (3%)
Jan	623	9 (2%)	389	-3 (-1%)	988	31 (3%)	412	13 (3%)
Feb	1,106	21 (2%)	637	29 (5%)	1,860	27 (1%)	766	21 (3%)
Mar	1,804	18 (1%)	1,041	31 (3%)	2,307	14 (1%)	1,101	30 (3%)
Apr	4,733	18 (0%)	4,156	48 (1%)	5,094	27 (1%)	4,251	74 (2%)
May	5,837	33 (1%)	4,983	19 (0%)	6,335	23 (0%)	5,143	72 (1%)
Jun	7,433	-7 (0%)	6,408	-48 (-1%)	7,612	38 (1%)	6,471	46 (1%)
Jul	7,841	41 (1%)	6,757	110 (2%)	8,147	12 (0%)	6,933	64 (1%)
Aug	7,017	14 (0%)	5,605	45 (1%)	7,244	-12 (0%)	5,679	10 (0%)
Sep	5,086	22 (0%)	4,003	62 (2%)	5,322	37 (1%)	4,066	119 (3%)
Total (TAF)	3,020	14 (0%)	2,493	29 (1%)	3,265	15 (0%)	2,581	34 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)
Note:
Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Key:
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Impact H&H-12 (CP1): Change in Groundwater Levels CP1 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping would result in increased groundwater levels. This impact would be beneficial.

With increased water supply deliveries to CVP and SWP water contractors, and an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP1. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. With less groundwater pumping, groundwater basins that were in overdraft conditions would be anticipated to recover as a result of increasing groundwater levels. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-13 (CP1): Change in Groundwater Quality CP1 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. This impact would be less than significant for groundwater quality.

With increased water supply deliveries to CVP and SWP water contractors, and an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP1. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. Because CP1 would have a positive, albeit limited, impact by reducing reliance on groundwater, the effects of CP1 on groundwater quality also would be limited. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP2 primarily consists of raising Shasta Dam by 12.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir’s full pool by 14.5 feet and would enlarge the total storage capacity in the reservoir by 443,000 acre-feet. The existing TCD also would be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 120 TAF and 60 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact H&H-1 (CP2): Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge Although flood management operations would not change under the CP2, a slight reduction could occur in the frequency of flows greater than 100,000 cfs. This impact would be beneficial.

SLWRI modeling uses a monthly time step, which is inappropriate for flood control analysis; however, flood management operations for downstream objectives would not change under CP1. Although a slight decrease in recurrence of high flows would be possible because of the increased storage capability, CP1 would not increase the frequency of flows above 100,000 cfs. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-2 (CP2): Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map This impact would be the same as Impact H&H-2 (CP1); no new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-3 (CP2): Place within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows This impact would be the same as Impact H&H-3 (CP1); no new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact H&H-4 (CP2): Change in Water Levels in Old River near Tracy Road Bridge Simulated water levels in the Old River near Tracy Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-43, maximum monthly reduction in minimum daily water level associated with CP2 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-43. Simulated Monthly Maximum 15-Minute Change in Old River Water Levels near Tracy Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP2 (2005) Change (feet)	CP2 (2030) Change (feet)
April	0 00 (0%)	-0.02 (0%)
May	-0.01 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.06 (0%)	-0.06 (0%)
August	-0.06 (0%)	-0.05 (0%)
September	-0.05 (0%)	-0.08 (0%)
October	-0.08 (0%)	-0.04 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 071_3116)

Notes:

Simulation period: 1922-2003

Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot

Key:

CP = comprehensive plan

Impact H&H-5 (CP2): Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier Simulated water levels in the Grant Line Canal near the Grant Line Canal Barrier show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-44, maximum monthly changes in minimum daily water level associated with CP2 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-44. Simulated Monthly Maximum 15-Minute Change in Grant Line Canal Water Levels near the Grant Line Canal Barrier at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP2 (2005) Change (feet)	CP2 (2030) Change (feet)
April	0.00 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.04 (0%)	-0.03 (0%)
July	-0.07 (0%)	-0.06 (0%)
August	-0.04 (0%)	-0.03 (0%)
September	-0.03 (0%)	-0.05 (0%)
October	-0.03 (0%)	-0.02 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 129_5691)
Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-6 (CP2): Change in Water Levels in the Middle River near the Howard Road Bridge Simulated water levels in the Middle River near the Howard Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-45, maximum monthly changes in minimum daily water level associated with CP2 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.3 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-45. Simulated Monthly Maximum 15-Minute Change in Middle River Water Levels near the Howard Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP2 (2005) Change (feet)	CP2 (2030) Change (feet)
April	0.00 (0%)	-0.02 (0%)
May	-0.01 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.06 (0%)	-0.06 (0%)
August	-0.06 (0%)	-0.05 (0%)
September	-0.05 (0%)	-0.09 (0%)
October	-0.08 (0%)	-0.05 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 206_5533)
Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-7 (CP2): Change in X2 Position The X2 Position would change from west to east of Collinsville in one December compared to the existing conditions, when the Delta would not be in balanced conditions. This impact would be less than significant.

Examination of simulation output indicates that compared to the existing condition, only in one month, December 1979, would the X2 position change from west to east of Collinsville. Under the existing conditions, the X2 position would be at 78.25 kilometers (km), and under CP2, it would be at 81.27 km, a 3.03 km shift; however the Delta was not in balanced conditions. When compared to the No-Action Alternative, CP2 shows no months when the No-Action Alternative would cause the X2 position to shift from west Collinsville to east of Collinsville when the Delta is not in balanced conditions. This single month change would not significantly limit CCWD's ability to fill Los Vaqueros Reservoir. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-8 (CP2): Change in Recurrence of Delta Excess Conditions Changes from excess to balance Delta conditions would be rare. This impact would be less than significant.

As shown in Table 6-46, CP2 would cause few changes from excess to balanced Delta conditions when compared to the existing condition and the No-Action Alternative. Because of the low number of occurrences, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-46. Simulated Number of Years the Delta Changes from Excess to Balanced Condition

	Number of Years the Delta Changes from Excess to Balanced Conditions Compared to Existing Condition or No-Action Alternative											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CP2 (2005)	1 (1%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	2 (2%)	0 (0%)
CP2 (2030)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	2 (2%)	0 (0%)	3 (4%)	3 (4%)	1 (1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations
Notes:
Simulation Period: 1922-2003
Number in parentheses indicates percentage of months Delta condition change occurs
Key:
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation

CVP/SWP Service Areas

Impact H&H-9 (CP2): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries would increase under all conditions. Average monthly deliveries would generally increase but could show small decreases in October and November of less than the significance criteria. This impact would be less than significant.

As shown in Table 6-47, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. Decreases of 2 and 6 percent average October delivery could occur under existing conditions when averaged over all years and dry and critical years respectively. A decrease of 1 percent average November delivery could occur under future conditions when averaged over dry and critical years. These decreases are less than the 10 percent decrease significance criteria. This impact is less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-47. Simulated Monthly Average Deliveries and Percent Change of Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP2 Change (cfs (%))	Existing Condition (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))
October	254	-4 (-2%)	251	-14 (-6%)	297	6 (2%)	275	15 (6%)
November	170	3 (2%)	159	11 (7%)	222	1 (0%)	215	-1 (-1%)
December	105	0 (0%)	104	0 (0%)	133	0 (0%)	132	0 (0%)
January	50	0 (0%)	50	0 (0%)	63	0 (0%)	62	0 (0%)
February	48	0 (0%)	52	0 (0%)	59	0 (0%)	62	0 (0%)
March	32	2 (5%)	33	2 (7%)	31	2 (6%)	29	3 (9%)
April	350	19 (5%)	243	21 (9%)	316	23 (7%)	199	21 (11%)
May	622	24 (4%)	363	25 (7%)	619	30 (5%)	328	24 (7%)
June	878	29 (3%)	500	29 (6%)	884	38 (4%)	452	32 (7%)
July	1,024	33 (3%)	579	36 (6%)	1,044	38 (4%)	540	29 (5%)
August	876	25 (3%)	520	27 (5%)	907	35 (4%)	498	36 (7%)
September	527	12 (2%)	348	14 (4%)	572	15 (3%)	370	12 (3%)
Total (TAF)	299	9 (3%)	194	9 (5%)	312	11 (4%)	192	10 (5%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-10 (CP2): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges This impact would be similar to Impact H&H-10 (CP1). Average annual and monthly deliveries would increase under both existing and future conditions, except the increase in deliveries would be greater under CP2. This impact would be less than significant.

As shown in Table 6-48, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison when averaging all years. For dry and critical years, average annual deliveries would increase under future condition and remain the same for existing conditions. However, some less than significant decreases could occur in monthly deliveries under existing conditions. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-48. Simulated Monthly Average Deliveries and Percent Change of Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP2 Change (cfs (%))	Existing Condition (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))
October	1,600	4 (0%)	1,473	4 (0%)	1,505	8 (1%)	1,369	12 (1%)
November	1,091	3 (0%)	996	3 (0%)	1,025	6 (1%)	923	9 (1%)
December	837	4 (0%)	715	4 (1%)	796	8 (1%)	664	12 (2%)
January	1,027	7 (1%)	818	8 (1%)	998	14 (1%)	771	22 (3%)
February	1,209	9 (1%)	948	10 (1%)	1,178	18 (1%)	895	27 (3%)
March	753	15 (2%)	451	9 (2%)	722	20 (3%)	385	12 (3%)
April	1,296	13 (1%)	834	-10 (-1%)	1,254	23 (2%)	737	11 (1%)
May	2,009	12 (1%)	1,325	-14 (-1%)	1,935	25 (1%)	1,181	19 (2%)
June	3,088	30 (1%)	1,935	5 (0%)	3,001	42 (1%)	1,743	32 (2%)
July	3,256	23 (1%)	1,923	-34 (-2%)	3,175	38 (1%)	1,688	4 (0%)
August	2,275	15 (1%)	1,296	-28 (-2%)	2,244	25 (1%)	1,100	63 (6%)
September	1,620	-8 (0%)	1,270	-15 (-1%)	1,531	20 (1%)	1,130	30 (3%)
Total (TAF)	1,212	8 (1%)	844	-4 (0%)	1,170	15 (1%)	760	15 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation TAF = thousand acre-feet

Impact H&H-11 (CP2): Change in Deliveries to SWP Table A Contractors
Average annual and monthly deliveries would increase under both existing and future conditions. This impact would be less than significant.

As shown in Table 6-49, average annual deliveries to SWP Table A contractors would increase under CP2 in both existing and future conditions relative to the bases of comparison in both average years and in dry and critical years. Some decreases in monthly average deliveries could occur under CP2 relative to existing conditions and the No-Action Alternative in both average annual and dry and critical years. These decreases would be less than 1 percent. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-49. Simulated Monthly Average Deliveries and Percent Change of Deliveries to SWP Table A Contractors

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP2 Change (cfs (%))	Existing Condition (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))	No-Action Alternative (cfs)	CP2 Change (cfs (%))
October	3,226	-7 (0%)	2,873	63 (2%)	3,351	44 (1%)	3,051	50 (2%)
November	2,689	51 (2%)	2,282	71 (3%)	2,812	18 (1%)	2,342	28 (1%)
December	2,476	33 (1%)	2,014	89 (4%)	2,886	38 (1%)	2,392	78 (3%)
January	623	18 (3%)	389	0 (0%)	988	49 (5%)	412	28 (7%)
February	1,106	32 (3%)	637	47 (7%)	1,860	52 (3%)	766	45 (6%)
March	1,804	28 (2%)	1,041	56 (5%)	2,307	27 (1%)	1,101	60 (5%)
April	4,733	24 (1%)	4,156	69 (2%)	5,094	35 (1%)	4,251	102 (2%)
May	5,837	43 (1%)	4,983	55 (1%)	6,335	31 (0%)	5,143	103 (2%)
June	7,433	-22 (0%)	6,408	-66 (-1%)	7,612	41 (1%)	6,471	61 (1%)
July	7,841	49 (1%)	6,757	146 (2%)	8,147	31 (0%)	6,933	133 (2%)
August	7,017	12 (0%)	5,605	45 (1%)	7,244	-13 (0%)	5,679	16 (0%)
September	5,086	47 (1%)	4,003	140 (3%)	5,322	52 (1%)	4,066	175 (4%)
Total (TAF)	3,020	19 (1%)	2,493	43 (2%)	3,265	24 (1%)	2,581	53 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-12 (CP2): Change in Groundwater Levels CP2 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping would result in increased groundwater levels. This impact would be beneficial.

With increased water supply deliveries to CVP and SWP water contractors, and with an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP2. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. With less groundwater pumping, groundwater basins that were in overdraft conditions would be anticipated to recover as a result of increasing groundwater levels. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-13 (CP2): Change in Groundwater Quality CP2 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. This impact would be less than significant.

With increased water supply deliveries to CVP and SWP water contractors, and with an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP2. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries could result in a decrease in groundwater pumping. Because CP2 could have a positive, albeit limited, impact by reducing reliance on groundwater, the effects of CP2 on groundwater quality also would be limited. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP3 primarily consists of raising Shasta Dam by 18.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 20.5 feet and would enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD also would be extended to achieve efficient use of the expanded cold-water pool. Because CP3 would focus on increasing agricultural water supply reliability, none of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact H&H-1 (CP3): Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge Although flood management operations would not change under CP3, a slight reduction could occur in the frequency of flows greater than 100,000 cfs. This impact would be beneficial.

SLWRI modeling uses a monthly time step, which is inappropriate for flood control analysis; however, flood management operations for downstream objectives would not change under CP3. Although a slight decrease in recurrence of high flows would be possible because of the increased storage capability, CP3 would not increase the frequency of flows above 100,000 cfs. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-2 (CP3): Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map This impact would be the same as Impact H&H-2 (CP1); no new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-3 (CP3): Place Within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows This impact would be the same as Impact H&H-3 (CP1); no new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact H&H-4 (CP3): Change in Water Levels in the Old River near Tracy Road Bridge Simulated water levels in the Old River near Tracy Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-50, maximum monthly reduction in minimum daily water level associated with CP3 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-50. Simulated Monthly Maximum 15-Minute Change in Old River Water Levels near Tracy Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP3 (2005) Change (feet)	CP3 (2030) Change (feet)
April	-0.01 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.02 (0%)	-0.03 (0%)
August	-0.02 (0%)	-0.05 (0%)
September	-0.10 (0%)	-0.07 (0%)
October	-0.06 (0%)	-0.05 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 071_3116)

Notes:

Simulation period: 1922-2003

Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot.

Key:

CP = comprehensive plan

Impact H&H-5 (CP3): Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier Similar to Impact H&H-5 (CP1), CP3 would have the potential to affect water levels in the Grant Line Canal above the Grant Line Canal Barrier. This impact would be less than significant.

As shown in Table 6-51, maximum monthly changes in minimum daily water level associated with CP3 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition. Similarly, when compared to the No-Action Alternative, maximum monthly changes would be less than 0.1 foot in all months during the irrigation season.

Table 6-51 also shows the percentage of months when the maximum decreases in water levels are greater than 0.1 feet when the water levels under the baseline conditions are below the identified limit of 0.3 feet in the Grant Line Canal near the Grant Line Canal Barrier. These maximum decreases in water lever would not violate the threshold and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-51. Simulated Monthly Maximum 15-Minute Change in Grant Line Canal Water Levels near the Grant Line Canal Barrier at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP3 (2005) Change (feet)	CP3 (2030) Change (feet)
April	0 00 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.04 (0%)	-0.03 (0%)
July	-0.02 (0%)	-0.03 (0%)
August	-0.01 (0%)	-0.03 (0%)
September	-0.04 (0%)	-0.04 (0%)
October	-0.03 (0%)	-0.02 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 129_5691)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot.
Key:
CP = comprehensive plan

Impact H&H-6 (CP3): Change in Water Levels in the Middle River near the Howard Road Bridge   This impact is similar to Impact H&H-6 (CP1). During the agricultural season (April through October), the maximum change in water level at low-low tide compared to the existing condition would exceed 0.1 foot in one month, September 1986. This impact would be less than significant.

As shown in Table 6-52, when compared to the No-Action Alternative, maximum monthly changes would be less than 0.1 foot in all months during the irrigation season. Table 6-52 also shows the percentage of months when the maximum decreases in water levels would be greater than 0.1 feet when the water levels under the baseline conditions were below the identified limit of 0.3 feet in the Middle River near the Howard Road Bridge. These maximum decreases in water lever would not violate the threshold and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-52. Simulated Monthly Maximum 15-Minute Change in Middle River Water Levels near the Howard Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP3 (2005) Change (feet)	CP3 (2030) Change (feet)
April	-0.01 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.02 (0%)	-0.03 (0%)
August	-0.02 (0%)	-0.04 (0%)
September	-0.11 (0%)	-0.07 (0%)
October	-0.07 (0%)	-0.05 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 206_5533)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-7 (CP3): Change in X2 Position The X2 Position would change from west to east of Collinsville in one December, compared with existing conditions and the No-Action Alternative, when the Delta would not be in balanced conditions. This impact would be less than significant.

Examination of simulation output indicates that compared to the existing condition, only in one month, December 1979, would the X2 position shift from west to east of Collinsville. Under existing conditions, the X2 position would be at 78.25 km, and under CP3, it would be at 81.37 km, a 3.12 km shift.

Compared with the No-Action Alternative, only in one month, December 1979, would the X2 position change from west to east of Collinsville. Under the No-Action Alternative, the X2 position would be at 78.63 km, and under CP3, it would be at 81.08 km, a 2.45 km shift.

This single month change would not substantially limit CCWD's ability to fill Los Vaqueros Reservoir. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-8 (CP3): Change in Recurrence of Delta Excess Condition Under CP3, changes from excess to balance Delta conditions would be rare. This impact would be less than significant.

As shown in Table 6-53, CP3 would cause few changes from excess to balanced Delta conditions when compared to the existing condition and to the No-Action Alternative. Because of the low number of occurrences, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-53. Simulated Number of Years the Delta Changes from Excess to Balanced Condition

	Number of Years the Delta Changes from Excess to Balanced Conditions Compared to Existing Condition or No-Action Alternative											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CP3 (2005)	1 (1%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	2 (2%)	0 (0%)	0 (0%)	1 (1%)	1 (1%)
CP3 (2030)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (5%)	1 (1%)	0 (0%)	2 (2%)	2 (2%)	0 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations
Notes:
Simulation Period: 1922-2003
Number in parentheses indicates percentage of months Delta condition change occurs.
Key:
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation

CVP/SWP Service Areas

Impact H&H-9 (CP3): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries would increase under all conditions. Average monthly deliveries would generally increase but could show small decreases in October and November of less than the significance criteria. This impact would be less than significant.

As shown in Table 6-54, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. A decrease of 2 percent average October delivery could occur under existing conditions when averaged over dry and critical years. A decrease of 2 percent average November delivery could occur under future conditions when averaged over dry and critical years. These decreases are less than the 10% decrease significance criteria. This impact is less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-54. Simulated Monthly Average Deliveries and Percent Change of Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP3 Change (cfs (%))	Existing Condition (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))
Oct	254	1 (0%)	251	-4 (-2%)	297	18 (6%)	275	40 (15%)
Nov	170	1 (0%)	159	3 (2%)	222	1 (0%)	215	-4 (-2%)
Dec	105	0 (0%)	104	0 (0%)	133	0 (0%)	132	0 (0%)
Jan	50	0 (0%)	50	0 (0%)	63	0 (0%)	62	0 (0%)
Feb	48	0 (0%)	52	0 (0%)	59	0 (0%)	62	0 (0%)
Mar	32	5 (14%)	33	7 (20%)	31	5 (15%)	29	7 (25%)
Apr	350	44 (13%)	243	53 (22%)	316	47 (15%)	199	57 (29%)
May	622	60 (10%)	363	69 (19%)	619	68 (11%)	328	75 (23%)
Jun	878	76 (9%)	500	88 (18%)	884	87 (10%)	452	99 (22%)
Jul	1,024	85 (8%)	579	100 (17%)	1,044	96 (9%)	540	106 (20%)
Aug	876	66 (8%)	520	77 (15%)	907	78 (9%)	498	90 (18%)
Sep	527	30 (6%)	348	36 (10%)	572	34 (6%)	370	39 (10%)
Total (TAF)	299	22 (7%)	194	26 (13%)	312	26 (8%)	192	31 (16%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-10 (CP3): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges This impact would be similar to Impact H&H-10 (CP1), except the increase in deliveries would be greater under CP3. This impact would be beneficial.

As shown in Table 6-55, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Table 6-55. Simulated Monthly Average Deliveries and Percent Change of Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP3 Change (cfs (%))	Existing Condition (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))
October	1,600	10 (1%)	1,473	15 (1%)	1,505	19 (1%)	1,369	27 (2%)
November	1,091	8 (1%)	996	12 (1%)	1,025	15 (1%)	923	21 (2%)
December	837	10 (1%)	715	16 (2%)	796	20 (3%)	664	29 (4%)
January	1,027	18 (2%)	818	29 (3%)	998	35 (4%)	771	51 (7%)
February	1,209	23 (2%)	948	36 (4%)	1,178	44 (4%)	895	63 (7%)
March	753	35 (5%)	451	26 (6%)	722	49 (7%)	385	53 (14%)
April	1,296	31 (2%)	834	2 (0%)	1,254	54 (4%)	737	51 (7%)
May	2,009	32 (2%)	1,325	2 (0%)	1,935	63 (3%)	1,181	72 (6%)
June	3,088	64 (2%)	1,935	31 (2%)	3,001	106 (4%)	1,743	122 (7%)
July	3,256	65 (2%)	1,923	0 (0%)	3,175	114 (4%)	1,688	109 (6%)
August	2,275	65 (3%)	1,296	50 (4%)	2,244	93 (4%)	1,100	176 (16%)
September	1,620	-2 (0%)	1,270	-16 (-1%)	1,531	31 (2%)	1,130	37 (3%)
Total (TAF)	1,212	22 (2%)	844	12 (1%)	1,170	39 (3%)	760	49 (6%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)
Notes:
Simulation period: 1922-2003.
Change as measured from either existing condition or No-Action Alternative.
Dry and critical years as defined by the Sacramento Valley Index.
Key:
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Impact H&H-11 (CP3): Change in Deliveries to SWP Table A Contractors
Average annual and monthly deliveries would decrease under both existing and future conditions. This decrease would be larger than what would occur under other alternative actions because of storage space dedicated to the SWP under all alternative actions except CP3. This decrease would be less than 5 percent. This impact would be less than significant.

As shown in Table 6-56, average annual deliveries to SWP Table A contractors would decrease under CP3 in both existing and future conditions relative to the bases of comparison in both average years and in dry and critical years. Under both existing conditions and future conditions, the average monthly deliveries would decrease less than 5 percent in most months in both average annual and dry and critical years. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-56. Simulated Monthly Average Deliveries and Percent Change of Deliveries to SWP Table A Contractors

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP3 Change (cfs (%))	Existing Condition (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))	No-Action Alternative (cfs)	CP3 Change (cfs (%))
October	3,226	-25 (-1%)	2,873	8 (0%)	3,351	-9 (0%)	3,051	-13 (0%)
November	2,689	4 (0%)	2,282	6 (0%)	2,812	1 (0%)	2,342	1 (0%)
December	2,476	4 (0%)	2,014	12 (1%)	2,886	-1 (0%)	2,392	38 (2%)
January	623	-6 (-1%)	389	-5 (-1%)	988	-20 (-2%)	412	-18 (-4%)
February	1,106	-6 (-1%)	637	-10 (-2%)	1,860	-13 (-1%)	766	-25 (-3%)
March	1,804	-6 (0%)	1,041	-14 (-1%)	2,307	-9 (0%)	1,101	-31 (-3%)
April	4,733	1 (0%)	4,156	-9 (0%)	5,094	2 (0%)	4,251	-25 (-1%)
May	5,837	17 (0%)	4,983	-14 (0%)	6,335	5 (0%)	5,143	-22 (0%)
June	7,433	22 (0%)	6,408	-11 (0%)	7,612	-8 (0%)	6,471	-87 (-1%)
July	7,841	-6 (0%)	6,757	-9 (0%)	8,147	-31 (0%)	6,933	-56 (-1%)
August	7,017	-25 (0%)	5,605	-58 (-1%)	7,244	-54 (-1%)	5,679	-132 (-2%)
September	5,086	-4 (0%)	4,003	-8 (0%)	5,322	4 (0%)	4,066	3 (0%)
Total (TAF)	3,020	-2 (0%)	2,493	-7 (0%)	3,265	-8 (0%)	2,581	-22 (-1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)
Notes:
Simulation period: 1922-2003.
Change as measured from either existing condition or No-Action Alternative.
Dry and critical years as defined by the Sacramento Valley Index.
Key:
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Impact H&H-12 (CP3): Change in Groundwater Levels CP3 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping would result in increased groundwater levels. This impact would be beneficial.

With increased water supply deliveries to CVP and SWP water contractors, and with an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP3. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. With less groundwater pumping, groundwater basins that were in overdraft conditions would be anticipated to recover as a result of increasing groundwater levels. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-13 (CP3): Change in Groundwater Quality CP3 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping could improve groundwater quality. This impact would less than significant.

With increased water supply deliveries to CVP and SWP water contractors, and with an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP3. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. Because CP3 would have a positive, albeit limited, impact by reducing reliance on groundwater, the effects of CP3 on groundwater quality also would be limited. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

CP4 focuses on increasing anadromous fish survival while also increasing water supply reliability. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP4 would increase the height of the reservoir full pool by 20.5 feet and would enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD also would be extended to achieve efficient use of the expanded cold-water pool. Of the increased reservoir storage space, about 378,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. Operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as under CP1, with 70 TAF and 35 TAF reserved to specifically focus on increasing M&I deliveries during dry and critical years, respectively.

Because CP4 would increase the active or useable storage in Shasta Reservoir by the same amount as under CP1, and the storage would be utilized under the same operational rules, releases from Shasta would be the same as under CP1. The additional storage that would be dedicated to increasing the supply of cold water, or the cold-water pool, would result in different Shasta storages, elevations, and release temperatures but not in any other downstream water operations.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact H&H-1 (CP4). Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge This impact would be the same as Impact H&H-2 (CP1). Although flood management operations would not change under CP4, a slight reduction could occur in the frequency of flows

greater than 100,000 cfs. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-2 (CP4). Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map This impact would be the same as Impact H&H-2 (CP1). No new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-3 (CP4). Place Within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows This impact would be the same as Impact H&H-3 (CP1). No new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact H&H-4 (CP4). Change in Water Levels in Old River near Tracy Road Bridge This impact would be the same as Impact H&H-4 (CP1). Simulated water levels in the Old River near Tracy show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-5 (CP4). Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier This impact would be the same as Impact H&H-5 (CP1). Simulated water levels in the Old River near Tracy Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-6 (CP4). Change in Water Levels in Middle River near the Howard Road Bridge This impact would be the same as Impact H&H-6 (CP1). Simulated water levels in the Middle River near the Howard Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-7 (CP4): Change in X2 Position This impact would be the same as Impact H&H-7 (CP1). The X2 position would not change from west to east of Collinsville in December or January, when the Delta would not be in balanced conditions. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-8 (CP4): Change in Recurrence of Delta Excess Conditions This impact would be the same as Impact H&H-8 (CP1); changes from excess to balance Delta conditions would be rare. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact H&H-9 (CP4): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges This impact would be the same as Impact H&H-9 (CP1). Average annual and monthly deliveries would increase under both existing and future conditions, but some small decreases could occur in monthly deliveries under both existing and future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-10 (CP4): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges This impact would be the same as Impact H&H-10 (CP1). Average annual and monthly deliveries would increase under both existing and future conditions. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-11 (CP4): Change in Deliveries to SWP Table A Contractors This impact would be the same as Impact H&H-11 (CP1). Average annual deliveries would increase under both existing and future conditions, but some less than significant decreases could occur in monthly deliveries under future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-12 (CP4). Change in Groundwater Levels This impact would be the same as Impact H&H-12 (CP1). CP4 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping would result in increased groundwater levels. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-13 (CP4). Change in Groundwater Quality This impact would be the same as Impact H&H-13 (CP1). CP4 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

CP5 primarily would consist of raising Shasta Dam by 18.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 20.5 feet and would enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD also would be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 150 TAF and 75 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries.

Shasta Lake and Vicinity The significance criteria for H&H do not apply in the Shasta Lake and vicinity geographic region; therefore, potential effects in that geographic region are not discussed further in this DEIS.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact H&H-1 (CP5): Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge Although flood management operations would not change under CP5, a slight reduction could occur in the frequency of flows greater than 100,000 cfs. This impact would be beneficial.

SLWRI modeling uses a monthly time step, which is inappropriate for flood control analysis; however, flood management operations for downstream objectives would not change under CP5. Although a slight decrease in recurrence of high flows would be possible because of the increased storage capability, CP1 would not increase the frequency of flows above 100,000 cfs. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-2 (CP5): Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map This impact would be the same as Impact H&H-2 (CP1). No new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-3 (CP5): Place within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows This impact would be the same as Impact H&H-3 (CP1). No new structures would be built downstream from Shasta Dam. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact H&H-4 (CP5): Change in Water Levels in Old River near Tracy Road Bridge Simulated water levels in the Old River near Tracy Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-57, maximum monthly reduction in minimum daily water level associated with CP3 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-57. Simulated Monthly Maximum 15-Minute Change in Old River Water Levels near Tracy Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP5 (2005) Change (feet)	CP5 (2030) Change (feet)
April	-0.01 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.06 (0%)	-0.09 (0%)
August	-0.07 (0%)	-0.08 (0%)
September	-0.07 (0%)	-0.08 (0%)
October	-0.07 (0%)	-0.06 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 071_3116)

Notes:

Simulation period: 1922-2003

Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot.

Key:

CP = comprehensive plan

Impact H&H-5 (CP5): Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier Simulated water levels in the Old River near Tracy show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-58, maximum monthly reduction in minimum daily water level associated with CP5 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.0 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-58. Simulated Monthly Maximum 15-Minute Change in Grant Line Canal Water Levels near the Grant Line Canal Barrier at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP5 (2005) Change (feet)	CP5 (2030) Change (feet)
April	0.00 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.04 (0%)	-0.03 (0%)
July	-0.07 (0%)	-0.08 (0%)
August	-0.05 (0%)	-0.05 (0%)
September	-0.03 (0%)	-0.05 (0%)
October	-0.03 (0%)	-0.03 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 129_5691)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot.
Key:
CP = comprehensive plan

Impact H&H-6 (CP5): Change in Water Levels in the Middle River near the Howard Road Bridge Simulated water levels in the Middle River near the Howard Road Bridge show very small reductions that would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

As shown in Table 6-59, maximum monthly reduction in minimum daily water level associated with CP5 would be less than 0.1 foot in all months during the irrigation season, compared to the existing condition and the No-Action Alternative. The water levels would remain above 0.3 feet elevation and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-59. Simulated Monthly Maximum 15-Minute Change in Middle River Water Levels near the Howard Road Bridge at Low-Low Tide

Month	Change from Existing Condition	Change from No-Action Alternative
	CP5 (2005) Change (feet)	CP5 (2030) Change (feet)
April	-0.01 (0%)	-0.02 (0%)
May	-0.02 (0%)	-0.02 (0%)
June	-0.05 (0%)	-0.05 (0%)
July	-0.06 (0%)	-0.08 (0%)
August	-0.07 (0%)	-0.08 (0%)
September	-0.07 (0%)	-0.09 (0%)
October	-0.08 (0%)	-0.07 (0%)

Source: Version 8.0.6 DSM2 2005 and 2030 simulations (Node 206_5533)

Notes:
Simulation period: 1922-2003
Number in parentheses indicates number of months with a maximum decrease in water level exceeding 0.1 foot
Key:
CP = comprehensive plan

Impact H&H-7 (CP5): Change in X2 Position The X2 Position would change from west to east of Collinsville in one December, compared with existing conditions and the No-Action Alternative when the Delta would not be in balanced conditions. This impact would be less than significant.

Examination of simulation output indicates that compared to the existing condition, only in one month, December 1979, would the X2 position shift from west to east of Collinsville. Under existing conditions, the X2 position would be at 78.25 km, and under CP5, it would be at 81.36 km, a 3.11 km shift. Compared to the No-Action Alternative, only in one month, December 1979, would the X2 position change from west to east of Collinsville. Under the No-Action Alternative, the X2 position would be at 78.63 km, and under CP5, it would be at 81.08 km, a 2.45 km shift. This single month change would not significantly limit CCWD's ability to fill Los Vaqueros Reservoir. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-8 (CP5): Change in Recurrence of Delta Excess Condition Under CP5, changes from excess to balance Delta conditions would be rare. This impact would be less than significant.

As shown in Table 6-60, CP5 would cause one March, one June, one August, one October, three Novembers, and one December to change from excess to balanced Delta conditions, when compared to the existing condition, and four Julys, one August five Octobers , and three Novembers when compared to the No-Action Alternative. Because of the low number of occurrences, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-60. Simulated Number of Years the Delta Changes from Excess to Balanced Condition

	Number of Years the Delta Changes from Excess to Balanced Conditions Compared to Existing Condition or No-Action Alternative											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CP5 (2005)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	1 (1%)	3 (4%)	1 (1%)
CP5 (2030)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (5%)	1 (1%)	0 (0%)	5 (6%)	3 (4%)	0 (0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations
Notes:
Simulation Period: 1922-2003
Number in parentheses indicates percentage of months Delta condition change occurs.
Key:
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation

CVP/SWP Service Areas

Impact H&H-9 (CP5): Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges Average annual deliveries would increase under all conditions. Average monthly deliveries would generally increase but could show small decreases in October of less than the significance criteria. This impact would be less than significant.

As shown in Table 6-61, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. Decreases of 1 and 10 percent average October delivery could occur under existing conditions when averaged over all and dry and critical years respectively. The decrease of 10 percent at the upper limit of the greater than 10 percent decrease significance criteria, and is only seen for the month of October and is only under one of the four possible performance measures and is not assumed significant. This impact is less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-61. Simulated Monthly Average Deliveries and Percent Change of Deliveries to North-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP5 Change (cfs (%))	Existing Condition (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))
October	254	-3 (-1%)	251	-25 (-10%)	297	3 (1%)	275	3 (1%)
November	170	1 (0%)	159	4 (3%)	222	2 (1%)	215	1 (0%)
December	105	0 (0%)	104	0 (0%)	133	0 (0%)	132	0 (0%)
January	50	0 (0%)	50	0 (0%)	63	0 (0%)	62	0 (0%)
February	48	0 (0%)	52	0 (0%)	59	0 (0%)	62	0 (0%)
March	32	4 (11%)	33	5 (15%)	31	4 (12%)	29	5 (19%)
April	350	34 (10%)	243	42 (17%)	316	38 (12%)	199	42 (21%)
May	622	46 (7%)	363	52 (14%)	619	53 (9%)	328	54 (16%)
June	878	57 (7%)	500	66 (13%)	884	67 (8%)	452	72 (16%)
July	1,024	63 (6%)	579	73 (13%)	1,044	74 (7%)	540	79 (15%)
August	876	50 (6%)	520	61 (12%)	907	61 (7%)	498	71 (14%)
September	527	22 (4%)	348	27 (8%)	572	26 (5%)	370	27 (7%)
Total (TAF)	299	17 (6%)	194	19 (10%)	312	20 (6%)	192	22 (11%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_N and DEL_CVP_PRF_N)

Note:

Simulation period: 1922-2003. Change as measured from either existing condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

cfs = cubic feet per second

CP = comprehensive plan

SLWRI = Shasta Lake Water Resources Investigation

TAF = thousand acre-feet

Impact H&H-10 (CP5): Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges This impact would be similar to Impact H&H-10 (CP1), except the increase in deliveries would be greater under CP5. This impact would be beneficial.

As shown in Table 6-62, average annual deliveries under both existing and future conditions would increase relative to the basis of comparison, when averaging all years and dry and critical years. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Table 6-62. Simulated Monthly Average Deliveries and Percent Change of Deliveries to South-of-Delta CVP Water Service Contractors and Refuges

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP5 Change (cfs (%))	Existing Condition (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))
October	1,600	6 (0%)	1,473	11 (1%)	1,505	13 (1%)	1,369	21 (2%)
November	1,091	4 (0%)	996	8 (1%)	1,025	10 (1%)	923	16 (2%)
December	837	6 (1%)	715	11 (2%)	796	13 (2%)	664	23 (3%)
January	1,027	11 (1%)	818	20 (2%)	998	23 (2%)	771	40 (5%)
February	1,209	13 (1%)	948	25 (3%)	1,178	29 (2%)	895	50 (6%)
March	753	22 (3%)	451	17 (4%)	722	35 (5%)	385	37 (10%)
April	1,296	20 (2%)	834	-9 (-1%)	1,254	38 (3%)	737	34 (5%)
May	2,009	18 (1%)	1,325	-11 (-1%)	1,935	41 (2%)	1,181	45 (4%)
June	3,088	37 (1%)	1,935	0 (0%)	3,001	69 (2%)	1,743	76 (4%)
July	3,256	34 (1%)	1,923	-30 (-2%)	3,175	70 (2%)	1,688	56 (3%)
August	2,275	19 (1%)	1,296	-33 (-3%)	2,244	44 (2%)	1,100	82 (7%)
September	1,620	-2 (0%)	1,270	-6 (0%)	1,531	26 (2%)	1,130	39 (3%)
Total (TAF)	1,212	11 (1%)	844	0 (0%)	1,170	25 (2%)	760	31 (4%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_CVP_PAG_S and DEL_CVP_PRF_S)
Notes:
Simulation period: 1922-2003.
Change as measured from either existing condition or No-Action Alternative.
Dry and critical years as defined by the Sacramento Valley Index.
Key:
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Impact H&H-11 (CP5): Change in Deliveries to SWP Table A Contractors

This impact would be similar to Impact H&H-11 (CP1), except the increase in average annual deliveries would be greater, and potential decreases in average monthly deliveries in some months could be slightly larger under CP5. This impact would be less than significant.

As shown in Table 6-63, average annual deliveries to SWP Table A contractors would increase under CP5, in both existing and future conditions relative to the bases of comparison in both average years and in dry and critical years. Some monthly average decreases around 1 percent could occur in deliveries relative to the No-Action Alternative under existing and future conditions in both average annual and dry and critical years. The average monthly deliveries would increase in all months under CP5 relative to the No-Action Alternative under future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 6-63. Simulated Monthly Average Deliveries and Percent Change of Deliveries to SWP Table A Contractors

Month	Existing Condition (2005)				Future Condition (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (cfs)	CP5 Change (cfs (%))	Existing Condition (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))	No-Action Alternative (cfs)	CP5 Change (cfs (%))
October	3,226	-8 (0%)	2,873	73 (3%)	3,351	57 (2%)	3,051	64 (2%)
November	2,689	79 (3%)	2,282	83 (4%)	2,812	32 (1%)	2,342	33 (1%)
December	2,476	19 (1%)	2,014	76 (4%)	2,886	49 (2%)	2,392	90 (4%)
January	623	22 (4%)	389	2 (1%)	988	55 (6%)	412	32 (8%)
February	1,106	36 (3%)	637	48 (8%)	1,860	59 (3%)	766	49 (6%)
March	1,804	27 (1%)	1,041	57 (5%)	2,307	30 (1%)	1,101	73 (7%)
April	4,733	17 (0%)	4,156	47 (1%)	5,094	40 (1%)	4,251	109 (3%)
May	5,837	47 (1%)	4,983	60 (1%)	6,335	36 (1%)	5,143	118 (2%)
June	7,433	7 (0%)	6,408	-24 (0%)	7,612	33 (0%)	6,471	44 (1%)
July	7,841	55 (1%)	6,757	166 (2%)	8,147	27 (0%)	6,933	126 (2%)
August	7,017	21 (0%)	5,605	80 (1%)	7,244	-20 (0%)	5,679	2 (0%)
September	5,086	54 (1%)	4,003	161 (4%)	5,322	71 (1%)	4,066	225 (6%)
Total (TAF)	3,020	23 (1%)	2,493	50 (2%)	3,265	28 (1%)	2,581	58 (2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Nodes DEL_SWP_PAG and DEL_SWP_PMI)
Notes:
Simulation period: 1922-2003.
Change as measured from either existing condition or No-Action Alternative.
Dry and critical years as defined by the Sacramento Valley Index.
Key:
cfs = cubic feet per second
CP = comprehensive plan
SLWRI = Shasta Lake Water Resources Investigation
TAF = thousand acre-feet

Impact H&H-12 (CP5): Change in Groundwater Levels CP5 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping would result in increased groundwater levels. This impact would be beneficial.

With increased water supply deliveries to CVP and SWP water contractors, and with an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP5. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. With less groundwater pumping, groundwater basins that were in overdraft conditions would be anticipated to recover as a result of increasing groundwater levels. This impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact H&H-13 (CP5): Change in Groundwater Quality CP5 would deliver additional surface water to CVP and SWP water contractors, reducing their need to pump groundwater. The reduction in groundwater pumping could improve groundwater quality. This impact would less than significant.

With increased water supply deliveries to CVP and SWP water contractors, and an associated increase in surface water supply reliability to those contractors, shortages in deliveries would decrease under CP5. Contractor responses to shortages in surface water deliveries would vary; some may elect to fallow their land, others may buy water on the transfer market, and some may pump groundwater. An increase in surface water deliveries would result in a decrease in groundwater pumping. Because CP5 would have a positive, albeit limited, impact by reducing reliance on groundwater, the effects of CP5 on groundwater quality also would be limited. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

6.3.4 Mitigation Measures

Table 6-64 presents a summary of mitigation measures for hydrology, hydraulics, and water management. No potentially significant impacts have been identified, and therefore no mitigation measures are proposed.

No-Action Alternative

No mitigation measures are required for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation measures are required for this alternative.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation measures are required for this alternative.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

No mitigation measures are required for this alternative.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation measures are required for this alternative.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation measures are required for this alternative.

Table 6-64. Summary of Mitigation Measures for Hydrology, Hydraulics, and Water Management

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact H&H-1: Change in Frequency of Flows above 100,000 cfs on the Sacramento River below Bend Bridge	LOS before Mitigation	NI	B	B	B	B	B
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	NI	B	B	B	B	B
Impact H&H-2: Place Housing or Other Structures within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map	LOS before Mitigation	NI	NI	NI	NI	NI	NI
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	NI	NI	NI	NI	NI	NI
Impact H&H-3: Place within a 100-Year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows	LOS before Mitigation	NI	NI	NI	NI	NI	NI
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	NI	NI	NI	NI	NI	NI
Impact H&H-4: Change in Water Levels in the Old River near Tracy Road Bridge	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact H&H-5: Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact H&H-6: Change in Water Levels in the Middle River near the Howard Road Bridge	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact H&H-7: Change in X2 Position	LOS before Mitigation	NI	NI	LTS	LTS	NI	LTS
	Mitigation Measure	None required	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	NI	NI	LTS	LTS	NI	LTS

Table 6-64. Summary of Mitigation Measures for Hydrology, Hydraulics, and Water Management (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact H&H-8: Change in Recurrence of Delta Excess Conditions	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact H&H-9: Change in Deliveries to North-of-Delta CVP Water Service Contractors and Refuges	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	PS	LTS	LTS	LTS	LTS	LTS
Impact H&H-10: Change in Deliveries to South-of-Delta CVP Water Service Contractors and Refuges	LOS before Mitigation	PS	B	LTS	B	B	B
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	PS	B	LTS	B	B	B
Impact H&H-11: Change in Deliveries to SWP Table A, Contractors	LOS before Mitigation	B	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	B	LTS	LTS	LTS	LTS	LTS
Impact H&H-12: Change in Groundwater	LOS before Mitigation	LTS	B	B	B	B	B
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	B	B	B	B	B
Impact H&H-13: Change in Groundwater Quality	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	No mitigation needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Key:
B = beneficial
LOS = level of significance
LTS = less than significant
NI = no impact
PS = potentially significant

6.3.5 Cumulative Effects

Chapter 3, "Considerations for Describing the Affected Environment and Environmental Consequences" discusses overall cumulative impacts of the action alternatives and, including the relationship to CALFED Programmatic Cumulative Impacts Analysis, qualitative and quantitative assessment, past and future actions in the primary and extended study areas, and significance criteria.

This section provides an analysis of overall cumulative impacts of the project alternatives with other past, present, and reasonably foreseeable future projects producing related impacts.

The projects listed in the quantitative analysis section of Chapter 3, "Considerations for Describing the Affected Environment and Environmental Consequences" are included in the 2030 level of development alternatives above. Accordingly, quantitative effects of the projects combined with the SLWRI alternatives are described in the Environmental Consequences section. The discussion below focuses on the qualitative effect of the SLWRI alternatives and the other past, present, and reasonably foreseeable future projects.

The effects of climate change on operations at Shasta Lake could result in changes to hydrology, hydraulics, and water management. As described in the Climate Change Projection Appendix, climate change could result in higher reservoir releases in the winter and early spring because of an increase in runoff during these times. The change in winter and early spring releases could necessitate managing flood events resulting from potentially larger storms. Similarly, climate change could result in lower reservoir inflows and Sacramento tributary flows during the late spring and summer because of a decreased snow pack. This reduction in inflow and tributary flow could result in Shasta Lake storage being reduced because of both a reduced ability to capture flows and an increased need to make releases to meet downstream requirements.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

As described in Section 6.3.3, no potentially significant impacts would occur under CP1.

When combined with other past, present, and reasonably foreseeable future projects, a change in the Sacramento River flows would be likely. Because Shasta Reservoir is operated to meet flow and water quality requirements in the Sacramento River and the Delta, a new project or program along the Sacramento River and in the Delta could affect the hydraulics, hydrology, and water resources of CP1. For instance, if the Shasta River Water Reliability Study (SRWRS) were implemented, Shasta Reservoir would be reoperated, resulting in changes to the Sacramento River flow regime and the Delta inflow. However, with the implementation of the other past, present, and reasonably foreseeable future projects, it is reasonable to assume that a reduction in flow requirements, or a reduction in the level of protection from current water quality requirements, would not occur. Therefore, during periods when the CVP and SWP are operated to meet regulatory constraints, the effects of the implementation of the projects described above would be limited.

Water levels in the south Delta could be affected by changes in Delta inflow and export pumping. Although regulatory requirements restrict export pumping when water levels in the south Delta reach certain levels, CP1 combined with other projects could result in changes to water levels during the irrigation season, at a magnitude and frequency that would affect south Delta water users. Accordingly, CP1 combined with a number of other projects could result in potentially significant and unavoidable impacts to south Delta water levels.

Both the X2 position and the Delta outflow are primarily products of Delta inflow and export pumping. A previously mentioned, CP1 combined with other projects could result in changes to Delta inflow and export pumping. Although CP1 would result in rare changes to either the X2 position or the Delta outflow of a magnitude affecting CCWD's ability to fill Los Vaqueros Reservoir, and would result in a less-than-significant impact on the X2 position, CP1 combined with other projects could result in potentially significant and unavoidable impacts.

As previously described, CP1 would have a beneficial impact on groundwater resources in the CVP/SWP service areas. Similarly, it is unlikely that CP1, when combined with other projects, would result in a decrease in surface water deliveries and an increased reliance on groundwater pumping relative to the bases of comparison. Accordingly, no impact on groundwater levels or groundwater quality would occur. Therefore, CP1, combined with other projects, would be likely to have a beneficial effect.

None of the other past, present, and reasonably foreseeable future projects would negatively affect Shasta Reservoir's ability to fill its flood management obligations. Consequently, when combined with CP1, either no cumulative impact or a beneficial impact on flood management would occur.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased inflows at other times. The additional storage associated with CP1 potentially would diminish these effects and allow Shasta Lake to capture some of the increased runoff in the winter and early spring for release in late spring and summer. Under CP1, the impact on flood management, water supply, south Delta water levels, and groundwater management would be less than significant. Therefore, even with the addition of the anticipated effects of climate change, CP1 would not have a significant cumulative effect, and could be beneficial.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

As described in Section 6.3.3, no potentially significant impacts would occur under CP2.

When combined with the other past, present, and reasonably foreseeable future projects, a change in the Sacramento River flows would be likely. Because Shasta Reservoir is operated to meet flow and water quality requirements in the Sacramento River and the Delta, a new project or program along the Sacramento River and in the Delta could affect the hydraulics, hydrology, and water resources of CP2. For instance, if the SRWRS were implemented, Shasta Reservoir would be reoperated, resulting in changes to the Sacramento River flow regime and the Delta inflow. However, with the implementation of the other past, present, and reasonably foreseeable future projects, it is reasonable to assume that a reduction in flow requirements, or a reduction in the level of protection from current water quality requirements, would not occur. Therefore, during periods when the CVP and SWP are operated to meet regulatory constraints, the effects of the implementation of the projects described above would be limited.

Water levels in the south Delta could be affected by changes in Delta inflow and export pumping. Although regulatory requirements restrict export pumping when water levels in the south Delta reach certain levels, CP2 combined with other projects could result in changes to water levels during the irrigation season, at a magnitude and frequency that would affect south Delta water users. Accordingly, CP2 combined with other projects could result in potentially significant and unavoidable impacts to south Delta water levels.

Both the X2 position and the Delta outflow are primarily products of Delta inflow and export pumping. A previously mentioned, CP2 combined with other projects could result in changes to Delta inflow and export pumping. Although CP2 would result in rare changes to either the X2 position or the Delta outflow of a magnitude affecting CCWD’s ability to fill Los Vaqueros Reservoir, and would result in a less–than-significant impact on the X2 position, CP2 combined with other projects possibly could result in potentially significant and unavoidable impacts.

As previously described, CP2 would have a beneficial impact on groundwater resources in the CVP/SWP service areas. Similarly, it is unlikely that CP2, when combined with other projects, would result in a decrease in surface water deliveries and an increased reliance on groundwater pumping relative to the bases of comparison. Accordingly, no impact on groundwater levels or groundwater quality would occur. Therefore, CP2, combined with other projects, would be likely to have a beneficial effect.

None of the other past, present, and reasonably foreseeable future projects would negatively affect Shasta Reservoir’s ability to fill its flood management obligations. Consequently, when combined with CP2, either no cumulative impact or a beneficial impact on flood management would occur.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased inflows at other times. The additional storage associated with CP2 potentially would diminish these effects and allow Shasta Lake to capture some of the increased runoff in the winter and early spring for release in late spring and summer. Under CP2, the impacts associated with flood management, water supply, south Delta water levels, and groundwater management would be less than significant. Therefore, even with the addition of the anticipated effects of climate change, CP2 would not have a significant cumulative effect, and could be beneficial.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

As described in Section 6.3.3, no potentially significant impacts would occur under CP3.

When combined with the other past, present, and reasonably foreseeable future projects, a change in the Sacramento River flows would be likely. Because Shasta Reservoir is operated to meet flow and water quality requirements in the Sacramento River and the Delta, a new project or program along the Sacramento River and in the Delta could affect the hydraulics, hydrology, and water resources of CP3. For instance, if the SRWRS were implemented, Shasta Reservoir would be reoperated, resulting in changes to the Sacramento River flow regime and the Delta inflow. However, with the implementation of the other past, present, and reasonably foreseeable future projects, it is reasonable to assume that a reduction in flow requirements, or a reduction in the level of protection from current water quality requirements, would not occur. Therefore, during periods when the CVP and SWP are operated to meet regulatory constraints, the effects of the implementation of the projects described above would be limited.

Water levels in the south Delta could be affected by changes in Delta inflow and export pumping. Although regulatory requirements restrict export pumping when water levels in the south Delta reach certain levels, CP3 combined with other projects could result in changes to water levels during the irrigation season, at a magnitude and frequency that would affect south Delta water users. Accordingly, CP3 combined with other projects could result in potentially significant and unavoidable impacts to south Delta water levels.

Both the X2 position and the Delta outflow are primarily products of Delta inflow and export pumping. A previously mentioned, CP3 combined with other projects could result in changes to Delta inflow and export pumping. Although CP3 would result in rare changes to either the X2 position or the Delta outflow of a magnitude affecting CCWD’s ability to fill Los Vaqueros Reservoir, and would result in a less-than-significant impact on the X2 position, CP3 combined with other projects possibly could result in potentially significant and unavoidable impacts.

As previously described, CP3 would have a beneficial impact on groundwater resources in the CVP/SWP service areas. Similarly, it is unlikely that CP3, when combined with a number of other projects, would result in a decrease in surface water deliveries and an increased reliance on groundwater pumping relative to the bases of comparison. Accordingly, no impact on groundwater levels or groundwater quality would occur. Therefore, CP3, combined with a number of other projects, would be likely to have a beneficial effect.

None of the other past, present, and reasonably foreseeable future projects would negatively affect Shasta Reservoir's ability to fill its flood management obligations. Consequently, when combined with CP3, either no cumulative impact or a beneficial impact on flood management would occur.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased inflows at other times. The additional storage associated with CP3 potentially would diminish these effects and allow Shasta Lake to capture some of the increased runoff in the winter and early spring for release in late spring and summer. Under CP3, the impact on flood management, water supply, south Delta Water levels, and groundwater management would be less than significant. Therefore, even with the addition of the anticipated effects of climate change, CP3 would not have a significant cumulative effect, and could be beneficial.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

As described in Section 6.3.3, no potentially significant impacts would occur under CP4.

When combined with the other past, present, and reasonably foreseeable future projects, a change in the Sacramento River flows would be likely. Because Shasta Reservoir is operated to meet flow and water quality requirements in the Sacramento River and the Delta, a new project or program along the Sacramento River and in the Delta could affect the hydraulics, hydrology, and water resources of CP4. For instance, if the SRWRS were implemented, Shasta Reservoir would be reoperated, resulting in changes to the Sacramento River flow regime and the Delta inflow. However, with the implementation of the other past, present, and reasonably foreseeable future projects, it is reasonable to assume that a reduction in flow requirements, or a reduction in the level of protection from current water quality requirements, would not occur. Therefore, during periods when the CVP and SWP are operated to meet regulatory constraints, the effects of the implementation of the projects described above would be limited.

Water levels in the south Delta could be affected by changes in Delta inflow and export pumping. Although regulatory requirements restrict export pumping when water levels in the south Delta reach certain levels, CP4 combined with other projects could result in changes to water levels during the irrigation season, at a magnitude and frequency that would affect south Delta water users. Accordingly, CP4 combined with other projects could result in potentially significant and unavoidable impacts to south Delta water levels.

Both the X2 position and the Delta outflow are primarily products of Delta inflow and export pumping. A previously mentioned, CP4 combined with other projects could result in changes to Delta inflow and export pumping. Although CP4 would result in rare changes to either the X2 position or the Delta outflow of a magnitude affecting CCWD's ability to fill Los Vaqueros Reservoir, and would result in a less-than-significant impact on the X2 position, CP4 combined with other projects possibly could result in potentially significant and unavoidable impacts.

As previously described, CP4 would have a beneficial impact on groundwater resources in the CVP/SWP service areas. Similarly, it is unlikely that CP4, when combined with other projects, would result in a decrease in surface water deliveries and an increased reliance on groundwater pumping relative to the bases of comparison. Accordingly, no impact on groundwater levels or groundwater quality would occur. Therefore, CP4, combined with other projects, would be likely to have a beneficial effect.

None of the other past, present, and reasonably foreseeable future projects would negatively affect Shasta Reservoir's ability to fill its flood management obligations. Consequently, when combined with CP4, either no cumulative impact or a beneficial impact on flood management would occur.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased inflows at other times. The additional storage associated with CP4 potentially would diminish these effects and allow Shasta Lake to capture some of the increased runoff in the winter and early spring for release in late spring and summer. Under CP4, the impact on flood management, water supply, south Delta water levels, and groundwater management would be less than significant. Therefore, even with the addition of the anticipated effects of climate change, CP4 would not have a significant cumulative effect, and could be beneficial.

CP5 – 18.5-Foot Dam Raise, Combination Plan

As described in Section 6.3.3, no potentially significant impacts would occur under CP5.

When combined with the other past, present, and reasonably foreseeable future projects, a change in the Sacramento River flows would be likely. Because Shasta Reservoir is operated to meet flow and water quality requirements in the

Sacramento River and the Delta, a new project or program along the Sacramento River and in the Delta could affect the hydraulics, hydrology, and water resources of CP5. For instance, if the SRWRS were implemented, Shasta Reservoir would be reoperated, resulting in changes to the Sacramento River flow regime and the Delta inflow. However, with the implementation of the other past, present, and reasonably foreseeable future projects, it is reasonable to assume that a reduction in flow requirements, or a reduction in the level of protection from current water quality requirements, would not occur. Therefore, during periods when the CVP and SWP are operated to meet regulatory constraints, the effects of the implementation of the projects described above would be limited.

Water levels in the south Delta could be affected by changes in Delta inflow and export pumping. Although regulatory requirements restrict export pumping when water levels in the south Delta reach certain levels, CP5 combined with other projects could result in changes to water levels during the irrigation season, at a magnitude and frequency that would affect south Delta water users. Accordingly, CP5 combined with other projects could result in potentially significant and unavoidable impacts to south Delta water levels.

Both the X2 position and the Delta outflow are primarily products of Delta inflow and export pumping. A previously mentioned, CP5 combined with other projects could result in changes to Delta inflow and export pumping. Although CP5 would result in rare changes to either the X2 position or the Delta outflow of a magnitude affecting CCWD’s ability to fill Los Vaqueros Reservoir, and would result in a less-than-significant impact on the X2 position, CP5 combined with other projects could result in potentially significant and unavoidable impacts.

As previously described, CP5 would have a beneficial impact on groundwater resources in the CVP/SWP service areas. Similarly, it is unlikely that CP5, when combined with other projects, would result in a decrease in surface water deliveries and an increased reliance on groundwater pumping relative to the bases of comparison. Accordingly, no impact on groundwater levels or groundwater quality would occur. Therefore, CP5, combined with other projects, would be likely to have a beneficial effect.

None of the other past, present, and reasonably foreseeable future projects would negatively affect Shasta Reservoir’s ability to fill its flood management obligations. Consequently, when combined with CP5, either no cumulative impact or a beneficial impact on flood management would occur.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased inflows at other times. The additional storage associated with CP5 potentially would diminish these effects and allow Shasta Lake to capture some of the increased runoff in the winter and early spring for release in late spring and summer. Under CP5, the impact on flood management, water supply, south Delta water levels, and groundwater management would be less than significant. Therefore, even with the addition of the anticipated effects of climate change, CP5 would not have a significant cumulative effect, and could be beneficial.

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Chapter 7
Water Quality

7.1 Affected Environment

This section describes the affected environment related to water quality for the dam and reservoir modifications proposed under SLWRI action alternatives. For more detail, please see the *Water Quality Technical Report*.

7.1.1 Overview of Water Quality Conditions

Surface water quality in the study area is affected by natural runoff, agricultural return flows, abandoned mines, construction, logging, grazing, and operations of flow-regulating facilities, urbanization, and recreation. This section discusses key water quality constituents of concern (i.e., temperature, sediments, and metals), the factors influencing their concentrations, and the regulatory objectives associated with maintaining beneficial uses.

The following discussion provides an overview of water quality and its relationship to beneficial uses throughout the primary and extended study areas. This section is followed by discussions of key water quality parameters that influence beneficial uses to varying degrees within the study areas; temperature, sediment and metals.

Shasta Lake and Vicinity

This section addresses water quality in the Shasta Lake and vicinity portion of the primary study area (see Figure 7-1). It focuses on the six arms of Shasta Lake and tributaries that enter into Shasta Lake from the surrounding watersheds.

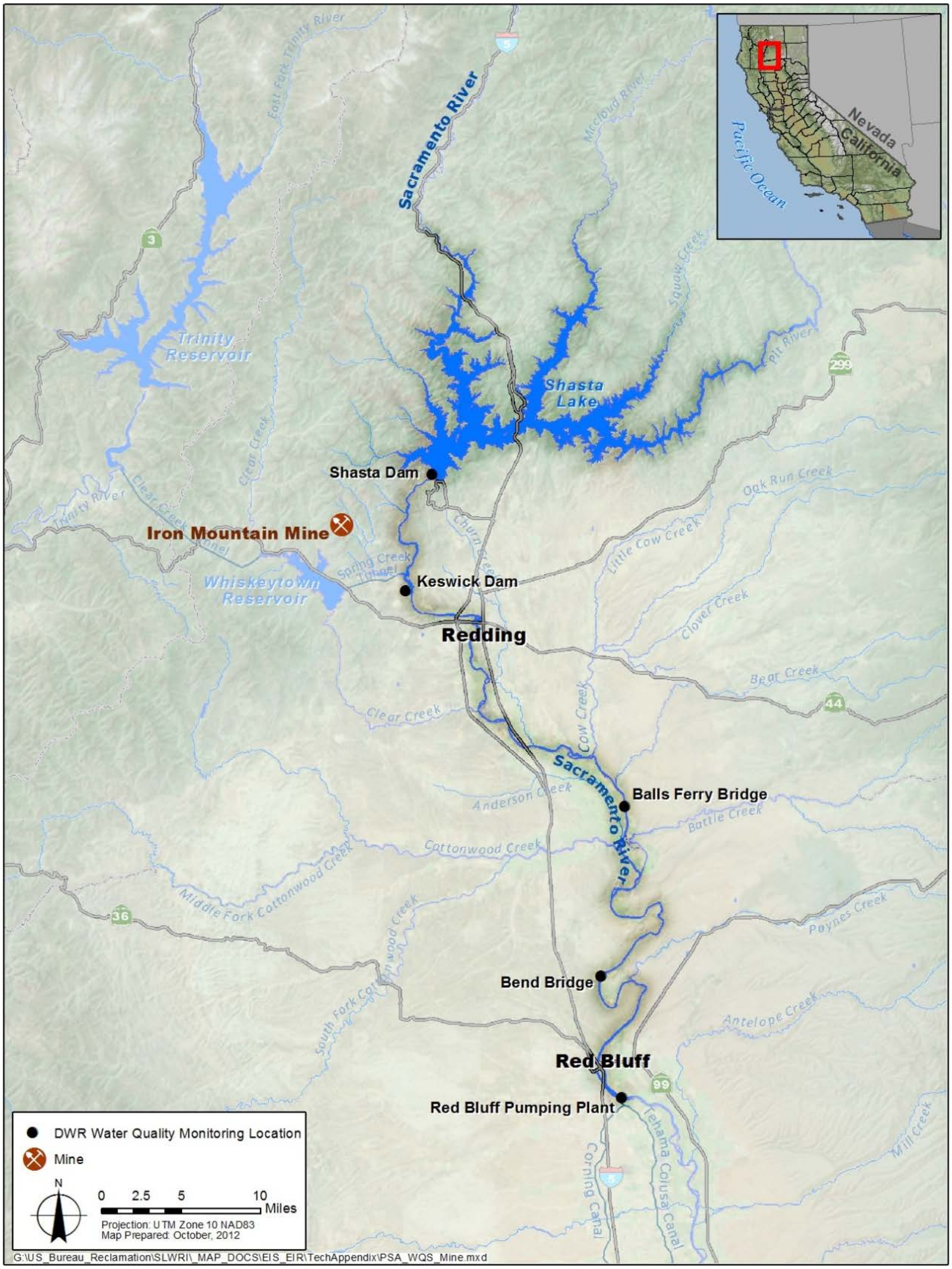


Figure 7-1. Upper Sacramento River Primary Study Area

Water quality in this portion of the primary study area generally meets the standards for beneficial uses identified in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) (CVRWQCB 2009). The quality of surface waters in Shasta County is generally considered good, although some water bodies are affected by nonpoint pollution sources that influence surface water quality: high turbidity from controllable sediment discharge sources (e.g., land development and roads); high concentrations of nitrates and dissolved solids from range and agricultural runoff or septic tank failures; contaminated street and lawn runoff from urban areas, roads, and railroads; acid mine drainage and heavy metal discharges from historic mining and processing operations; and warm-water discharges into cold-water streams.

The quality of water in underground basins and water-bearing soils is also considered generally good throughout most of Shasta County. Potential hazards to groundwater quality involve nitrates and dissolved solids from agricultural and range practices and septic tank failures. The ability of soils in Shasta County to support septic tanks and on-site wastewater treatment systems is generally severely limited, particularly on older valley terrace soils and certain loosely confined volcanic soils in the eastern portions of the county (CVRWQCB 2011).

The surface water quality of streams and lakes draining Shasta-Trinity National Forest (STNF) and adjacent private lands generally meets standards for beneficial uses defined by the Basin Plan (CVRWQCB 2011). However, some areas exist where the water quality does not meet the standards during periods of storm runoff because of past management activities, or as a result of drainage from historic mining and processing operations. These water courses include West Squaw Creek below the Balakala Mine, lower Little Backbone Creek, lower Horse Creek, and Town Creek, which are all listed by the U.S. Environmental Protection Agency (EPA) as impaired water bodies under Section 303(d) of the Clean Water Act (CWA). The cumulative impacts of successive activities, such as road construction and timber harvesting on private and National Forest lands, also contribute to the degradation of water quality in STNF (USFS 1995). Within this portion of the primary study area, most of the road construction and timber harvest activities occur on private lands.

Shasta Dam and Shasta Lake constitute the “keystone of the Central Valley Project.” Approximately 6.2 million acre-feet of water flows annually into Shasta Lake from the Sacramento River, McCloud River, and Pit River drainages. A favorable inflow-outflow relationship of 1.4 to 1 results in good water quality, both in the lake and downstream (USFS 1996), although 20 acres where West Squaw Creek enters Shasta Lake is listed as an impaired water body on the EPA’s Section 303(d) list as impaired due to heavy metal accumulations (e.g., cadmium, copper and zinc) at locations throughout the reservoir (CVRWQCB 2011). Shasta Lake is listed on the EPA’s 2008–2010 Section 303(d) list as impaired by mercury throughout the lake.

Nutrient inputs and bacteria are not of concern in the Sacramento and McCloud arms (USFS 1998); however, they could be an issue in the Pit Arm as a result of runoff from agricultural and range lands in the upper Pit River watershed. Within Little Backbone Creek, and West Squaw Creek, the waters are locally limited by low pH and elevated concentrations of heavy metals caused by drainage from abandoned mines and are hence are listed as impaired on the EPA's Section 303(d) list (CVRWQCB 2003a). In addition, data suggest that sediment and turbidity locally affect beneficial uses, mainly contact recreation. A recent 2-year study conducted by the State Water Resources Control Board (SWRCB) sampled mercury accumulations in fish at a number of locations throughout Shasta Lake. This study documented elevated levels of mercury in some specimens (Davis et al. 2010).

Upper Sacramento River (Shasta Dam to Red Bluff)

Tributaries to the Upper Sacramento River, and place names referred to in the text are shown in Figure 7-1. The main sources of water in the Sacramento River below Keswick Dam are rain and snowmelt that collect in upstream reservoirs and are released in response to water needs or flood control. The quality of surface water downstream from Keswick Dam is also influenced by other human activities along the Sacramento River downstream from the dam, including agricultural, historical mining, and municipal and industrial (M&I) inputs.

The quality of water in the Sacramento River is relatively good. Only during conditions of stormwater-driven runoff are water quality objectives typically not met (Domagalski et al. 2000). Water quality issues within the primary study area of the Sacramento River include the presence of mercury, pesticides such as organochlorine pesticides, trace metals, turbidity, and toxicity from unknown origin (CALFED 2000a).

Water quality in the Sacramento River and its major tributaries above Red Bluff Pumping Plant (RBPP) is generally good (Table 7-1). Nutrients such as nitrate were found to be low throughout the Sacramento River basin (Domagalski and Dileanis 2000, as cited in Domagalski et al. 2000). Water temperature is a principal water quality issue in the upper Sacramento River between Keswick Dam and RBPP.

Table 7-1. Summary of Conventional Water Quality Constituents Collected in the Sacramento River at Red Bluff from 1996 to 1998

Constituent (unit)	Water Quality Objective	Average Measurement
Conventional Physical and Chemical Constituents		
Temperature	< 2.5ºF [a]	52.7ºF
Conductivity (µS/cm)	–	116
Dissolved Oxygen (mg/L)	7.0 [b]	10.7
Dissolved Oxygen Saturation (%)	85 [b]	99
pH (standard unit)	6.5 to 8.5 [c]	7.8
Alkalinity (mg/L $CaCO_3$)	–	48.3
Total Hardness (mg/L $CaCO_3$)	–	46.6
Suspended Sediment (mg/L)	–	38.8
Calcium (mg/L)	narrative [d]	10.3
Magnesium (mg/L)	–	5.0
Sodium (mg/L)	–	5.8
Potassium (mg/L)	–	1.1
Chloride (mg/L)	500 [e]	2.4
Conventional Physical and Chemical Constituents		
Sulfate (mg/L)	500 e	4.5
Silica (mg/L)	–	20.5
NO2 + NO3 (mg/L N)	NO3 < 10 f	0.12
Total Phosphorus (mg/L P)	–	0.0477
Trace Metals		
Arsenic (µg/L)	50 [g]	1.0
Chromium (µg/L)	180 [g]	1.0
Copper (µg/L)	5.1 [g]	1.6
Mercury (µg/L)	0.050 [g]	0.0045
Nickel (µg/L)	52 [g]	1.2
Zinc (µg/L)	120 [g]	2.3
Organic Pesticides		
Molinate (ng/L)	13,000 [h]	< 60
Simazine (ng/L)	3,400 [i]	< 22
Carbofuran (mg/L)	40,000 [e], 500 [i]	< 31
Diazinon (mg/L)	51 [j]	< 28
Carbaryl (ng/L)	700 [k]	< 41
Thiobencarb (ng/L)	1,000 [a]	< 38
Chlorpyrifos (ng/L)	14 [j]	< 25
Methidathion (ng/L)	–	< 38

Table 7-1. Summary of Conventional Water Quality Constituents Collected in the Sacramento River at Red Bluff from 1996 to 1998 (contd.)

Source: CBDA 2005

Notes:
[a] The Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) water quality objective for allowable change from controllable factors.
[b] Basin Plan water quality objective.
[c] Basin Plan water quality objective; < 0.5 allowable change from controllable factors.
[d] Basin Plan narrative objective: Water will not contain constituent in concentrations that would cause nuisance or adversely affect beneficial uses.
[e] Secondary drinking water maximum contaminant level (MCL).
[f] Primary drinking water MCL.
[g] California Toxics Rule (CTR) aquatic life criteria for 4-day average dissolved concentration.
[h] CTR human health maximum criteria total recoverable concentration.
[i] California Department of Fish and Game hazard assessment value.
[j] California Department of Fish and Game aquatic life guidance value for 4-day average concentration.
[k] U.S. Environmental Protection Agency Integrated Risk Information System reference dose for drinking water quality.

Key:
– = not applicable
°F = degrees Fahrenheit
µg/L = micrograms per liter
µS/cm = microSiemens per centimeter
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
N = nitrogen
ng/L = nanograms per liter
NO_2 = nitrate
NO_3 = nitrite
P = phosphorus

Although all trace metals shown in Table 7-1 were well below their established water quality objectives, one of the principal water quality issues in the upper Sacramento River portion of the primary study area is acid mine drainage and associated heavy-metal contamination from the Spring Creek drainage and other abandoned mining sites. It should be noted that the U.S. Geological Survey (USGS) study detected mercury, but it did not exceed the criterion of ambient level specified in the California Toxics Rule; however, California Toxics Rule levels for mercury are not protective to prevent the high concentration of mercury found in fish tissue. In addition to heavy metal contamination, the Central Valley Regional Water Quality Control Board (CVRWQCB) determined that the 25-mile reach of the Sacramento River from Keswick Dam downstream to Cottonwood Creek is impaired because the water periodically contains levels of dissolved cadmium, copper, and zinc that exceed levels identified to protect aquatic organisms. The 26-mile reach from Keswick Dam to Red Bluff is listed for unknown sources of toxicity (CVRWQCB 2007a).

Lower Sacramento River and Delta

Water quality in the lower Sacramento River is affected by agricultural runoff, acid mine drainage, stormwater discharges, water releases from dams, diversions, and urban runoff. However, the flow volumes generally provide sufficient dilution to prevent excessive concentrations of contaminants in the river.

Several total maximum daily loads (TMDL) are currently proposed for the lower Sacramento River. In addition, the Sacramento River downstream from Red Bluff to Knights Landing is listed as an impaired water body under the EPA's Section 303(d) list for mercury and unknown toxicity. Elevated metals and pesticide levels have been found at some sites in the Sacramento River Valley downstream from Knights Landing. The parameters of concern in the Sacramento River from Knights Landing to the Delta include diazinon, mercury, and unknown sources of toxicity (CVRWQCB 2007a, 2007b).

Water quality in the Delta is highly variable temporally and spatially. It is a function of complex circulation patterns that are affected by inflows, pumping for Delta agricultural operations and exports, operation of flow control structures, and tidal action. The existing water quality problems of the Delta system may be categorized as presence of toxic materials, eutrophication and associated fluctuations in dissolved oxygen, presence of suspended sediments and turbidity, salinity, and presence of bacteria (SWRCB 1999).

The Delta waterways within the area under the CVRWQCB's jurisdiction are listed as impaired on the EPA's 303(d) list for dissolved oxygen, electrical conductivity (EC), dichlorodiphenyl-trichloroethane, mercury, Group A pesticides, diazinon and chlorpyrifos, and unknown toxicity (CVRWQCB 2003b). The area of the Delta that is under the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (RWQCB) is listed as impaired for mercury, chlordane, selenium, dichlorodiphenyl-trichloroethane, dioxin compounds, polychlorinated biphenyl compounds, dieldrin, nickel, exotic species, and furan compounds (SFBRWQCB 2007).

Organic carbon in the Delta originates from runoff from agricultural and urban land, drainage water pumped from Delta islands that have soils with high organic matter, runoff and drainage from wetlands, wastewater discharges, and primary production in Delta waters. Delta agricultural drainage can also contain high levels of nutrients, suspended solids, organic carbon, minerals (salinity), and trace chemicals such as organophosphate, carbamate, and organochlorine pesticides.

Salinity is also an important water quality constituent in the Delta. Salinity in the Delta is the result of tidal exchange with San Francisco Bay, variations in freshwater inflow from the San Joaquin and Sacramento rivers, agricultural and urban exports/diversions, and agricultural return flows. During dry conditions, seawater intrusion is the primary factor influencing Delta salinity and can adversely affect agricultural and municipal uses. The highest concentrations typically occur in late summer or early fall.

CVP/SWP Service Areas

The CVP and SWP service areas are affected by water quality from the Delta. Water quality concerns of particular concern are those related to salinity and drinking-water quality. Salinity is an issue because excessive salinity may adversely affect crop yields and require more water for salt leaching, may require additional M&I treatment, may increase salinity levels in agricultural soils and groundwater, and is the primary water quality constraint to recycling wastewater (CALFED 2000b).

Constituents that affect drinking-water quality include bromide, natural organic matter, microbial pathogens, nutrients, total dissolved solids (TDS), hardness, alkalinity, pH, organic carbon, disinfection byproducts, and turbidity.

7.1.2 Sediment

Shasta Lake and Vicinity

Sediment-caused turbidity is one of the limiting water quality issues for Shasta Lake and its tributaries. It is a noticeable recurring water quality problem that affects beneficial uses, including recreation and fisheries. Within the reservoir, turbid water results from clay- and silt-sized soil particles suspended in the water column. Under certain conditions, inflow to the Pit Arm appears to be influenced by water quality conditions upstream from Shasta Lake, but monitoring data are not available to adequately document this phenomenon.

Before the construction of Shasta Dam, the widespread loss of vegetation caused by historic copper mining and smelting operations resulted in large-scale erosion, particularly in the watersheds that are tributary to the Main Body of Shasta Lake and the Squaw Creek Arm. In addition to sediment sources from upland areas, including roads and historic mining features, the construction and operation of Shasta Dam continue to influence erosional processes that introduce sediment into Shasta Lake, causing turbid conditions that are visible to the casual observer.

Nonpoint sources of fine sediment that increase turbidity in Shasta Lake include sediment discharge from tributaries, wave-related erosion below and adjacent to the fluctuating water surface, and surficial erosion of exposed surfaces as the lake levels fluctuate (USFS 1996). Erosion of the fine-textured soil and rock types that constitute much of the shoreline is a predominant factor in causing turbidity. The turbid water is noticeable along the shoreline throughout the year, but typically increases during wind and runoff events. Plumes of turbid water entering from tributaries are also visible periodically throughout the year. The fluctuation of lake levels, combined with various wave-generating processes, also influences the degree and location of erosion-related turbidity. Turbidity and, to a lesser degree, sediment suspended in the water column influence recreational uses of the lake, including fishing, swimming, and boating, by decreasing the clarity of the water along the shoreline.

Although some amount of fine sediment is transported downstream from Shasta Dam, the size and location of the reservoir provide an efficient sediment trap for material typically mobilized as bedload. Additional discussion of erosional processes is provided in Chapter 4, “Geology, Geomorphology, Minerals, and Soils.”

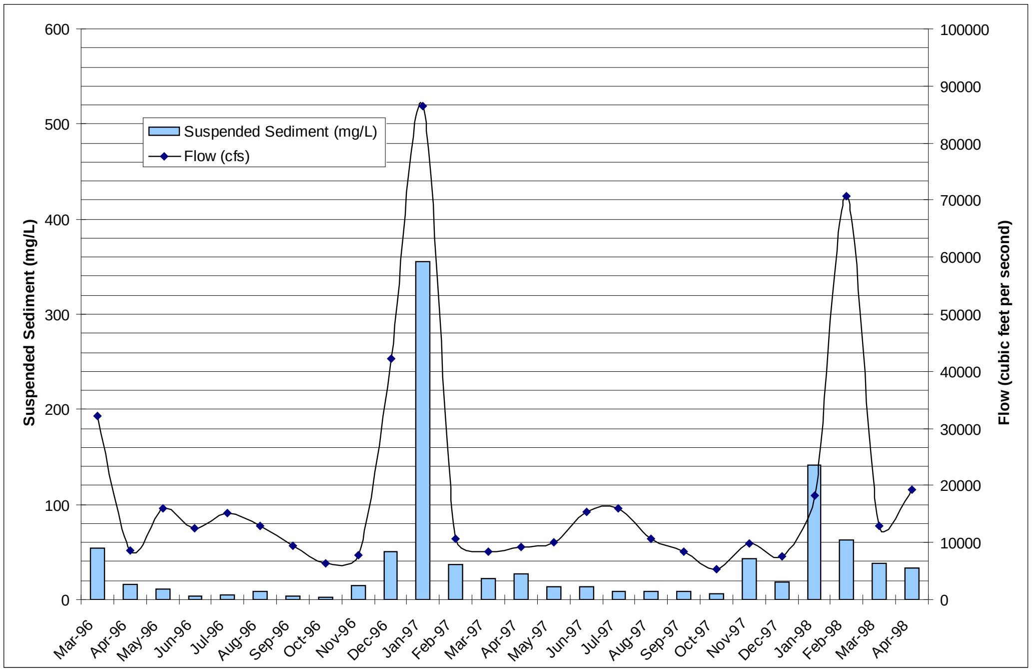
Upper Sacramento River (Shasta Dam to Red Bluff)

Rates of loading and discharge of suspended sediment within the upper Sacramento River watershed have been altered by activities such as mining, smelting, agriculture, urbanization, and dam construction. The storage and diversion of water within reservoirs for either hydroelectric or other purposes can affect sediment yield, downstream sediment levels, and transport characteristics. In particular, dams such as Shasta can trap sediment and result in the depletion of coarse sediments needed by fisheries. This has resulted in the creation of gravel replenishment programs on the upper Sacramento River as part of the Central Valley Project Improvement Act restoration program.

Historic hydraulic gold mining has probably had the greatest effect on sediment yield in the Sacramento River watershed (Wright and Schoellhamer 2004). During the late 1800s, such mining introduced mass quantities of silt, sand, and gravel into the Sacramento River system. Suspended sediment was washed downstream into the Delta. Current sediment transport patterns in the Sacramento River watershed are greatly affected by the trapping of sediment in reservoirs such as Shasta Lake (Wright and Schoellhamer 2004).

Characteristics of peak-flow events are fundamental regulators of sediment mobilization, bed scour, riparian recruitment, and bank erosion. However, upstream sediment supply rates and sediment load distribution also affect suspended sediment loading (CALFED 2003). The upper Sacramento River contributes little coarse sediment from erosion because it is bounded by erosion-resistant bedrock and terrace deposits (Stillwater Sciences 2006). Therefore, today a decreasing trend in suspended sediment exists in the Sacramento River (Wright and Schoellhamer 2004).

USGS assessed concentrations of suspended sediment in the Sacramento River at Big Bend above Red Bluff from February 1996 to April 1998 (USGS 2000a). Concentrations of suspended sediment ranged from 3 milligrams per liter (mg/L) to 355 mg/L, with an average of 38.8 mg/L (see Figure 7-2).



Source: USGS 2000a

Figure 7-2. Concentrations of Suspended Sediment and Associated Flows in the Sacramento River Above Big Bend near Red Bluff

Lower Sacramento River and Delta

Delivery of suspended sediment from the Sacramento River to the Delta and finally to San Francisco Bay decreased by about one-half during the period 1957 to 2001 (Wright and Schoellhamer 2004). Factors contributing to this trend in sediment yield included the depletion of erodible sediment from hydraulic mining in the late 1800s, trapping of sediment in reservoirs, riverbank protection, altered land uses, and levee construction.

Sediment supply to the Sacramento and San Joaquin river watersheds has declined over recent years because dams on rivers and other water management actions have resulted in less sediment transport (CALFED 2000c), although agricultural drainage in the Delta often contains high levels of suspended sediments (Reclamation and DWR 2005). Sediments that include fine sands, silts, and clays are transported by rivers and the Yolo Bypass into the Delta. Coarser materials are deposited at points higher up in the river basins. The sands typically are transported in the bed load, while the clays and silts move the suspended load. The suspended load is composed of generally finer materials moving downstream in the water column. Sediment loads from the Sacramento River are higher than those from the San Joaquin River (Reclamation and DWR 2005).

Hydraulic gold mining, particularly through the major westerly flowing tributaries such as the American, Feather, Yuba, and Bear rivers, may also affect sediment transport in the extended study area. USGS found that the Sacramento River is the primary supplier of suspended sediment to the Delta.

CVP/SWP Service Areas

Some suspended sediments are transported within the CVP and SWP service areas, but turbidity and sedimentation are not issues within the service areas (CALFED 2000c).

7.1.3 Temperature

Shasta Lake and Vicinity

Water temperature is an important water quality parameter affecting the beneficial uses of Shasta Lake and its tributaries, including contact and noncontact recreation and aquatic organisms. Within the reservoir, water temperature commonly controls the growth of algae and the rate of biochemical processes. Shasta Lake periodically stratifies and a thermocline develops on an annual basis, although turnover is incomplete and the lake has not been known to freeze over (Bartholow et al. 2001). Strong stratification of the reservoir occurs during summer at a depth of 10 to 15 meters. This stratification isolates the epilimnion from nutrients available in the deeper hypolimnion, segregating spring and fall algal blooms when water temperatures might otherwise support algal production in the euphotic zone, the zone close to the surface that provides opportunities for photosynthesis. The period of stratification generally overlaps with the peak recreation season (May to September), when surface water temperatures are comfortable for contact recreation activities. During fall, the stratification dissipates and the surface water temperature is reduced.

Shasta Dam operations greatly influence the annual and seasonal water temperature of the reservoir. The wetness of a given water year or series of years generally controls the mean annual water temperature. The current temperature regime of Shasta Lake is related to CVP operational requirements, including those necessary to optimize the water temperatures in the Sacramento River downstream from Keswick Dam. Overall, the tributaries that enter Shasta Lake meet the Basin Plan water quality objective for temperature.

Upper Sacramento River (Shasta Dam to Red Bluff)

Water temperature in the Sacramento River from Shasta Dam to Keswick Dam is determined primarily by Shasta Dam releases. Shasta Dam release flows are then mixed with flows from Whiskeytown Reservoir at Keswick Reservoir and released into the upper Sacramento River.

Water temperature for rivers within the Sacramento River basin is reportedly maintained consistent with regulatory requirements (e.g., NMFS biological opinion (BO)) most of the time, but temperature management can be difficult during low-flow periods (USGS 2000a). Historically, low-flow events and a lack of flexibility in dam operations can cause water temperatures to periodically approach critical levels for sustaining juvenile salmon populations.

In addition to low flows, high water temperatures released from reservoirs, coupled with natural instream warming, can cause elevated river water temperatures (Vermeyen 1997).

A number of water quality objectives exist for the upper Sacramento River. The Basin Plan specifies that water temperature will not be elevated above 56 degrees Fahrenheit (°F) from Keswick Dam to Hamilton City (+9). In addition, the Basin Plan specifies that at no time or place will the temperature of cold or warm intrastate waters be increased more than 5°F above natural receiving-water temperature (CVRWQCB 2009). Keswick Dam releases are managed to meet temperature control requirements.

On December 15, 2008, USFWS issued the *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the CVP and SWP* (2008 USFWS BO) for delta smelt and its critical habitat. On June 4, 2009, NMFS issued the *BO and Conference Opinion on the Long-Term Operations of the CVP and SWP* (2009 NMFS BO) for listed anadromous fishes and marine mammal species and their critical habitats. According to the 2009 NMFS BO, the Sacramento River water temperatures will be below 56°F at compliance locations between Balls Ferry and Bend Bridge from April 15 through September 30 to protect winter-run Chinook salmon, and when possible, not in excess of 56°F at the same compliance locations between Balls Ferry and Bend Bridge from October 1 through October 31 to protect spring-run Chinook salmon.

Before 1997, to help meet the needs of federally listed winter-run Chinook salmon, cold water was released from low outlets at Shasta Dam. These cold-water releases bypassed hydropower facilities, causing the loss of power revenues. To achieve water temperature objectives in the Sacramento River without interrupting power generation, Reclamation constructed a temperature control device (TCD) on Shasta Dam that became operational in 1997. The TCD allows selective withdrawal of water from different reservoir depths without bypassing power generation, provides flexibility to Shasta Dam operations, and allows downstream temperature goals to be consistently achieved.

Historical Sacramento River water temperatures below Shasta Dam were analyzed from January 1991 through December 2005. The data set indicates that average temperatures vary seasonally, ranging from 47.9°F in February to 55.7°F in November. Water temperatures below Keswick Dam were analyzed for January 1990 through December 2006. Like the temperatures below Shasta Dam, average temperatures below Keswick Dam vary seasonally, ranging from 47.8°F in February to 54.9°F in November. Summer and fall temperatures typically increase by about 7°F. Water temperatures just downstream from Keswick Dam are influenced by releases from Shasta Lake and Whiskeytown Reservoir and Keswick Dam operations.

Lower Sacramento River and Delta

Water temperature in the Sacramento River at Colusa varies seasonally, ranging from 47.5°F to 67.5°F. Water temperatures gradually increase through the spring and summer and reach an average of about 65°F. Water temperature in the Sacramento River at Freeport varies seasonally, ranging from 48.7°F to 72.1°F (USGS 2000a).

Water temperature in the Delta is influenced only slightly by water management activities (i.e., dam releases) (Reclamation and DWR 2005). The 2004 and 2009 BOs for Sacramento River winter-run Chinook salmon are among the most influential factors governing Shasta releases, in terms of both quantity and timing (NMFS 2004, 2009). The BOs set temperature requirements below Keswick Dam for April through October. In years when CVP facilities cannot be operated to meet required temperature and storage objectives, Reclamation reinitiates consultation with NMFS (NMFS 2009).

CVP/SWP Service Areas

Water quality in the CVP and SWP service areas, including water temperature, is affected by fluctuations of water quality in the Delta, which in turn are influenced by water quality in the San Joaquin River, CVP and SWP export pumping rates, local agricultural diversions and drainage water, and the Sacramento River (CALFED 2000c).

7.1.4 Metals

Shasta Lake and Vicinity

Certain areas of Shasta Lake have been identified as impaired by toxic metal pollutants. For this reason, Shasta Lake is listed on the EPA’s Section 303(d) list of impaired water bodies. For water bodies on the Section 303(d) list, the CWA requires the development of TMDL allocations for the pollutants of concern. A TMDL allocation must estimate the total maximum daily load, with seasonal variations and a margin of safety, for all suitable pollutants and thermal loads, at a level that would ensure protection and propagation of a balanced population of indigenous fish, shellfish, and wildlife. Table 7-2 shows the potential sources of pollution within specific areas of Shasta Lake, along with the TMDL priority and the estimated affected area of the pollutants.

Table 7-2. CWA Section 303(d) List of Water Quality Limited Segments, Shasta Lake, 2010

Pollutant	Potential Sources	TMDL Priority	Estimated Area Affected
Horse Creek, Town Creek, and Little Backbone Creek			
Cadmium	Resource extraction	Low	1.50 miles
Copper	Resource extraction	Low	1.50 miles
Lead	Resource extraction	Low	1.50 miles
Zinc	Resource extraction	Low	1.50 miles
All of Shasta Lake			
Mercury	**Resource extraction**	**Low**	**430 miles**
Area where West Squaw Creek enters Squaw Creek Arm of Shasta Lake			
Cadmium	Resource extraction	Low	20 acres
Copper	Resource extraction	Low	20 acres
Zinc	Resource extraction	Low	20 acres

Source: SWRCB 2006a

Key:
TMDL = total maximum daily load

Waters discharged by stream channels draining the areas disturbed by the mining of sulfide ore deposits are generally acidic and contain high concentrations of dissolved metals, including iron, copper, and zinc. The streams with the highest metal concentrations are Flat Creek (below Shasta Dam), Little Backbone Creek, Spring Creek (below Shasta Dam), West Squaw Creek, Horse Creek, and Zinc Creek (USGS 1978). Dissolved metals concentrations discharged by these streams violate water quality objectives (CVRWQCB 2003b). The sources of the metals are surface and groundwater discharge from underground mines and waters flowing through open pits, tunnels, mine tailing deposits, waste rock, and tertiary deposits that include modern alluvium along the shoreline. Interaction with sulfide minerals and erosion of metal-rich material commonly result in low pH readings and high metal concentrations.

The sources of the metals in the two areas identified in Table 7-2 are associated with the Bully Hill/Rising Star mining complex adjacent to West Squaw Creek. Although the mines are no longer operational and remedial action continues, these areas are a documented source of metals and continue to be subject to an abatement order issued by the CVRWQCB. A containment structure constructed sometime during the early 1900s has filled with sediment downstream from the Bully Hill Mine. No information is available on the character of the material stored behind this earth fill dam. In 2006, North State

Resources, Inc., conducted a Phase 1 Site Assessment of an area adjacent to, but over a small divide from, the Bully Hill Mine. This assessment documented elevated levels of sulfide minerals in sediment samples and extremely low pH values in surface waters draining the mine (NSR 2007).

Tributaries to the Main Body of Shasta Lake are also a source of metals, along with acid mine drainage from a number of mines in the West Squaw Creek and Little Backbone Creek watersheds. In addition to runoff from the historic workings (i.e., adits and portals), a number of large mine tailing deposits are currently leaching various metals into tributaries to Shasta Lake (CVRWQCB 2003a).

Between 2002 and 2003, the CVRWQCB conducted an investigation intended to increase the understanding of the relationship between elevated metal concentrations (dissolved copper and zinc) in discharges from Shasta Dam and the temporal and spatial distribution of these metals within and upslope of Shasta Lake (CVRWQCB 2003a). Specifically, this investigation attempted to answer two questions:

- Why do these elevated metal concentrations appear seasonally?
- Are the concentrations somehow related to the operation of the temperature control device that is attached to the upstream face of Shasta Dam?

In 2003, the CVRWQCB issued an interim report that provided data and limited analysis at 17 sites upstream from Shasta Dam. The data set included 412 discrete samples and included 1,043 specific chemical analyses for various chemical constituents (CVRWQCB 2003b). The interim report offers the following conclusion: “This study shows a direct correlation between dissolved copper concentrations in the upper water column near the dam and dissolved copper concentrations immediately downstream from the dam in the winter months.” The report goes on to suggest that this correlation may somehow be related to the operation of the temperature control device as it relates to the seasonal thermocline that develops in Shasta Lake (CVRWQCB 2003b).

Upper Sacramento River (Shasta Dam to Red Bluff)

A major source of metals to the Sacramento River is drainage from inactive mines in the Iron Mountain area of the West Shasta mining district. During mining and smelting activities from the 1880s to the 1960s, Iron Mountain’s acid mine drainage discharged directly to Spring Creek, a Sacramento River tributary upstream from Redding (USGS 2000b).

USGS conducted a water quality assessment of trace metal concentrations in the Sacramento River at Big Bend above Red Bluff from February 1996 to May 1998 (USGS 2000b). Although metals concentrations are a serious water quality concern in the project area, metals did not exceed water quality objectives during the study period.

The CVRWQCB has determined that the 25-mile segment of the upper Sacramento River between Keswick Dam and Cottonwood Creek near Balls Ferry in Shasta County is impaired because of levels of dissolved cadmium, copper, and zinc that exceed water quality standards (CVRWQCB 2002). The impairment results primarily from inactive mines in the upper Sacramento River watershed, predominantly the Iron Mountain site upstream from Keswick Dam and other mines upstream from Shasta Dam.

Water quality enhancement actions at the mines and improved coordination of the Spring Creek and Keswick Reservoirs have resulted in a notable decrease in the number of water quality targets exceeded in the past 10 years. However, metal loading remains high enough to cause periodic exceedences (CVRWQCB 2002). The sediments found in the Spring Creek Arm of Keswick Reservoir contain high levels of copper and zinc, which settled out of the contaminated stormwater runoff from the Iron Mountain Mine Superfund site. In 2009 and 2010, EPA dredged and removed contaminated sediments at this location with the goal of protecting the downstream Sacramento River ecosystem during storm events, when contaminated sediments can become mobilized and carried downstream. EPA expects that dredging the contaminated sediments will eliminate the last major threat that contamination from the Iron Mountain Mine poses to human health and the environment (EPA 2009).

High mercury concentrations in the Sacramento River correlate with concentrations of suspended sediment and high flows, because much of the mercury is transported adsorbed to suspended sediments (Domagalski et al. 2000). In May 2000, EPA adopted a water quality objective for total mercury for the Sacramento River watershed of 50 nanograms per liter (30-day average). In a USGS study of mercury levels along the Sacramento River at Big Bend above Red Bluff, conducted from February 1996 to May 1998, mercury levels were consistently below the EPA criterion of 50 nanograms per liter (USGS 2000b).

Lower Sacramento River and Delta

The downstream tributaries Cache Creek and Putah Creek are known to be substantial sources of mercury to the Sacramento River. The Sacramento River from Knights Landing to the Delta is listed as impaired on EPA's 303(d) list for mercury (CVRWQCB 2002).

The Delta waterways within the area under the CVRWQCB's jurisdiction are listed on EPA's 303(d) list as impaired for mercury from agriculture and historic mining, while the western Delta, under the jurisdiction of the San Francisco Bay RWQCB, is listed as impaired for mercury, nickel, and selenium. The primary sources of mercury are abandoned mine sites in the upper watershed that drain into the lower Sacramento River and Delta. The City of

Sacramento is also the largest urban source of nitrogen, mercury, and assorted other urban waste products. Selenium concentrations are attributed to agriculture and oil refiners, while the primary source of nickel is unknown (SWRCB 2006a).

CVP/SWP Service Areas

Water quality in the CVP and SWP service areas is affected by fluctuations of water quality in the south Delta, which in turn are influenced by water quality in the San Joaquin River, CVP and SWP export pumping rates, local agricultural diversions and drainage water, and the Sacramento River (CALFED 2000c).

7.1.5 Salinity

The following discussion of the affected environment in the study area with regard to salinity is limited to a discussion of conditions in the lower Sacramento River and Delta portion of the extended study area because of the potential effects of salinity in this geographic area on beneficial uses. Salinity is particularly important in the Delta, which is influenced by tidal exchange with San Francisco Bay; during low-flow periods, seawater intrusion results in increased salinity.

Lower Sacramento River and Delta

The following are recognized water quality issues in the Delta (Reclamation and DWR 2005):

- High salinity from Suisun Bay intrudes into the Delta during periods of low Delta outflow. Salinity can adversely affect agricultural, M&I, and recreational uses.

- Delta exports contain elevated concentrations of disinfection byproduct precursors (e.g., dissolved organic carbon), and the presence of bromide increases the potential for formation of brominated compounds in treated drinking water.

- Agricultural drainage in the Delta contains high levels of nutrients, suspended solids, dissolved organic carbon and minerals (salinity), and agricultural chemicals (pesticides).

- Synthetic organic chemicals and heavy metals have bioaccumulated in Delta fish and other aquatic organisms, occasionally exceeding standards for food consumption.

- The San Joaquin River inflow to the delta is typically lower quality than delta inflow from other tributary sources such as the Sacramento River. Because the south Delta receives a substantial portion of water from the San Joaquin River, the influence of this relatively poor San Joaquin River water quality is greatest in the south Delta channels and in CVP and SWP exports.

Trends in Delta water quality reflect the effects of river inflows, tidal exchanges with San Francisco Bay, diversions, and pollutant releases. The north Delta tends to have better water quality primarily because of inflow from the Sacramento River. The quality of water in the west Delta is strongly influenced by tidal exchange with San Francisco Bay; during low-flow periods, seawater intrusion results in increased salinity. In the south Delta, water quality tends to be poorer because of the combination of inflows of poorer water quality from the San Joaquin River, discharges from Delta islands, export pumping, seasonal agricultural barriers, and effects of diversions that can sometimes increase seawater intrusion from San Francisco Bay.

The Sacramento and San Joaquin rivers contribute approximately 61 percent and 33 percent, respectively, to TDS concentrations within the Delta from tributary inflows. TDS concentrations are relatively low in the Sacramento River, but because of its large volumetric contribution, the river provides the majority of the TDS load supplied by tributary inflow to the Delta (DWR 2001). Although actual flow from the San Joaquin River is lower than flow from the Sacramento River, TDS concentrations in San Joaquin River water average approximately seven times the TDS concentrations in the Sacramento River.

7.2 Regulatory Framework

Several regulatory authorities at the Federal, State, and local levels control the flow, quality, and supply of water in California either directly or indirectly. This section focuses on laws related directly to the water quality aspect of the project.

Management of the Delta is partly determined by Federal and State regulations developed to protect both human and environmental beneficial uses. Primary institutional and regulatory influences on the use and management of the Delta consist of the CVP; the SWP; direct Delta diverters, including Contra Costa Water District (CCWD), Solano County Water Agency, and the City of Stockton Metropolitan Area; San Francisco Bay water quality needs; and multiple regulations governing protection of endangered species.

At the State level, the SWRCB and the RWQCBs regulate and monitor Delta water quality. Nine regional boards oversee water quality in California. Two of these, the CVRWQCB and San Francisco Bay RWQCB, oversee Delta water quality. EPA also plays an important role under the auspices of the CWA and the Safe Drinking Water Act (SDWA). The California Department of Public Health has an interest in the Delta because the Delta is the source of drinking water for more than 23 million Californians. DWR extensively monitors Delta water quality as part of its Municipal Water Quality Investigations program; in cooperation with Reclamation, DWR monitors Delta water quality under the SWRCB's compliance monitoring requirements.

At the local level, water agencies that divert from the Delta have both strong interest in and influence on Delta water quality management. These agencies include CCWD, Solano County Water Agency, and City of Stockton Metropolitan Area.

Two agencies with key planning roles in the Delta are the California Bay-Delta Authority and the Delta Protection Commission. The California Bay-Delta Authority became a State agency in January 2003, and is responsible for implementing the CALFED Bay-Delta Program (CALFED). State legislation created the Delta Protection Commission in 1992 with the goal of developing regional policies for the Delta to protect and enhance existing land uses. In 2000, the commission was made a permanent State agency. The Delta Protection Commission comments on applications for CALFED ecosystem restoration grants that affect the Delta and participates in meetings with other CALFED agencies to provide input to CALFED management decisions.

7.2.1 Federal

Safe Drinking Water Act

The SDWA was established to protect the quality of drinking water in the United States. The SDWA authorized EPA to set national health-based standards for drinking water and requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells. Furthermore, the SDWA requires all owners or operators of public water systems to comply with primary (health-related) standards. EPA has delegated to the California Department of Public Health, Division of Drinking Water and Environmental Management, the responsibility for administering California's drinking-water program. California Department of Public Health is accountable to EPA for program implementation and for adopting standards and regulations that are at least as stringent as those developed by EPA. Contaminants of concern relevant to domestic water supply are defined as those that pose a public health threat or that alter the aesthetic acceptability of the water. These types of contaminants are regulated by EPA primary and secondary maximum contaminant levels that are applicable to treated water supplies delivered to the distribution system. Maximum contaminant levels and the process for setting these standards are reviewed triennially.

Clean Water Act

The CWA is the major Federal legislation governing the water quality aspects of the project. The objective of the act is "to restore and maintain the chemical, physical, and biological integrity of the nation's waters." The CWA establishes the basic structure for regulating discharge of pollutants into the waters of the United States and gives EPA the authority to implement pollution control programs such as setting wastewater standards for industries. In certain states such as California, EPA has delegated authority to state agencies.

Section 303 This section of the CWA requires states to adopt water quality standards for all surface waters of the United States. The three major components of water quality standards are as follows:

- **Designated uses –** Uses that society, through the Federal and State governments, determines should be attained in the water body, such as supporting communities of aquatic life, supplying water for drinking, irrigating crops and landscaping, and industrial purposes, and recreational uses (e.g., fishing, swimming, boating).

- **Water quality criteria** – Levels of individual pollutants or water quality characteristics, or descriptions of conditions of a water body that, if met, will generally protect the designated use of the water. Water quality criteria must be scientifically consistent with attainment of designated uses, which means that only scientific considerations can be taken into account when determining what water quality conditions are consistent with meeting a given designated use. Economic and social impacts are not considered when developing water quality criteria.

- **Antidegradation policy** – Designed to prevent deterioration of existing levels of good water quality (see the "Antidegradation Policy" section below for more information).

Where multiple uses exist, water quality standards must protect the most sensitive use. In California, EPA has given the SWRCB and its nine RWQCBs the authority to identify beneficial uses and adopt applicable water quality objectives.

Section 303(d) of the CWA requires states and authorized Native American tribes to develop a list of water quality–impaired segments of waterways. The list includes waters that do not meet water quality standards necessary to support the beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. Only waters impaired by "pollutants," not those impaired by other types of "pollution" (e.g., altered flow and/or channel modification), are to be included on the list. (Pollutants include clean sediments, nutrients (e.g., nitrogen and phosphorus), pathogens, acids/bases, temperature, metals, cyanide, and synthetic organic chemicals.)

Section 303(d) of the CWA also requires states to maintain a listing of impaired water bodies so that a TMDL can be established. A TMDL is a plan to restore the beneficial uses of a stream or to otherwise correct an impairment. It establishes the allowable pollutant loadings or other quantifiable parameters (e.g., pH or temperature) for a water body and thereby provides the basis for the establishment of water quality-based controls. The calculation for establishment of TMDLs for each water body must include a margin of safety to ensure that the water body can be used for the purposes the State has designated. Additionally, the calculation also must account for seasonal variation in water quality. The CVRWQCB develops TMDLs for the Sacramento River (see discussion on the Porter-Cologne Water Quality Control Act below). Sedimentation/siltation impacts are the primary water quality parameters of concern with construction projects.

Reductions in pollutant loading are achieved by implementing strategies authorized by the CWA, such as the following, which are discussed in more detail below.

- **Section 401 –** This section of the CWA requires Federal agencies to obtain certification from the State or Native American tribes before issuing permits that would result in increased pollutant loads to a water body. The certification is issued only if such increased loads would not cause or contribute to exceedences of water quality standards.
- **Section 402 –** This section creates the National Pollutant Discharge Elimination System (NPDES) permit program. This program covers point sources of pollution discharging into a surface water body.
- **Section 404 –** This section regulates the placement of dredged or fill materials into wetlands and other waters of the United States.

Section 401 – Water Quality Certification This section of the CWA requires an applicant for any Federal license or permit (e.g., a Section 404 permit) that may result in a discharge into waters of the United States to obtain a certification from the State that the discharge would comply with provisions of the CWA. The SWRCB and RWQCBs administer this program. The SWRCB issues Section 401 certifications for projects that would take place in two or more regions. Any condition of a Section 401 certification (or water quality certification) would be incorporated into the USACE permit.

The CVRWQCB has jurisdiction over the primary study area, but the extended study area encompasses the San Francisco Bay, Central Coast, Los Angeles, Lahontan, Colorado River basin, and the Santa Ana and San Diego RWQCBs. A Section 401 certification would not be required from the RWQCBs within the extended study area because no construction would occur in the extended study area.

Section 402 – National Pollutant Discharge Elimination System All point sources that discharge into waters of the United States must obtain an NPDES permit under provisions of Section 402 of the CWA. As with Section 401, the SWRCB and RWQCBs are responsible for implementing the NPDES permitting process at the State and regional levels, respectively.

The NPDES permit process also provides a regulatory mechanism for controlling nonpoint-source pollution created by runoff from construction and industrial activities, and general and urban land use, including runoff from streets. Projects involving construction activities (e.g., clearing, grading, or excavation) involving land disturbance greater than one acre must file a notice of intent with the appropriate RWQCB(s) to indicate their intent to comply with the General Permit for Discharges of Stormwater Associated with Construction Activity (Construction General Permit Order 2009-0009-DWQ, which went into effect and replaced Order 99-08-DWQ on July 1, 2010). This general permit establishes conditions to minimize sediment and pollutant loadings and requires preparation and implementation of a stormwater pollution prevention plan (SWPPP) before construction. The SWPPP is intended to help identify the sources of sediment and other pollutants, and to establish best management practices (BMP) for stormwater and nonstormwater source control and pollutant control. A sediment monitoring plan must be included in the SWPPP if the discharges occur directly to a water body listed on the Section 303(d) TMDL list for sediment.

The CVRWQCB has jurisdiction over the primary study area. A NPDES would not be required from the RWQCBs within the extended study area because no construction would occur.

Section 404 – Discharge of Dredged or Fill Material into Waters of the United States Section 404 deals with one broad type of pollution – the placement of dredged or fill material into “waters of the United States.” Jurisdictional limits of these features are typically noted by the ordinary high-water mark. Isolated ponds or seasonal depressions had been previously regulated as waters of the United States. However, in *Solid Waste Agency of Northwestern Cook County v. United States Army Corps of Engineers et al.* (January 8, 2001), the U.S. Supreme Court ruled that certain “isolated” wetlands (e.g., nonnavigable, isolated, and intrastate) do not fall under the jurisdiction of the CWA and are no longer under USACE jurisdiction. (Although isolated wetlands may not be under Federal regulation, they are regulated by the State of California (see Porter-Cologne Water Quality Control Act discussion below). Some circuit courts (e.g., *U.S. v. Deaton*, 2003; *U.S. v. Rapanos*, 2003; *Northern California River Watch v. City of Healdsburg*, 2006), however, have ruled that Solid Waste Agency of Northwestern Cook County does not prevent CWA jurisdiction if a “significant nexus” such as a hydrologic connection exists. The hydrologic connection may be human-made (e.g., roadside ditch) or a natural tributary to navigable waters, or direct seepage from the wetland to the navigable water, a surface or underground hydraulic connection. An ecological connection (e.g., the same bird, mammal, and fish populations are supported by both the wetland and the navigable water) and changes to chemical concentrations in the navigable water caused by water from the wetland may also constitute a significant nexus.

The discharge of dredge or fill generally includes the following activities:

- Placement of fill that is necessary for the construction of any structure or infrastructure in a water of the United States
- The building of any structure, infrastructure, or impoundment requiring rock, sand, dirt, or other material for its construction
- Site-development fills for recreational, industrial, commercial, residential, or other uses
- Causeways or road fills
- Dams and dikes
- Artificial islands
- Property protection and/or reclamation devices such as riprap, groins, seawalls, breakwaters, and revetments
- Beach nourishment
- Levees
- Fill for structures such as sewage treatment facilities, intake and outfall pipes associated with powerplants, and subaqueous utility lines
- Placement of fill material for construction or maintenance of any liner, berm, or other infrastructure associated with solid waste landfills
- Placement of overburden, slurry, mine tailing deposits, or similar mining-related materials
- Artificial reefs

USACE regulations and policies mandate avoiding the filling of wetlands unless it can be demonstrated that no practicable alternatives (to filling wetlands) exist. Four basic processes exist for obtaining Section 404 authorization from USACE. Because of its scale and potential impact, this project would require an individual permit.

USACE's Sacramento District has jurisdiction over the primary study area, but the extended study area encompasses the San Francisco and Los Angeles Districts of USACE.

Antidegradation Policy

The Antidegradation Policy, established in 1968 and revised in 2005 (Title 40, Code of Federal Regulations, Section 131.12), is designed to protect existing uses and water quality and national water resources, as authorized by Section

303(c) of the CWA. At a minimum, the policy and implementation methods must be consistent with the following:

- Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

- Where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable BMPs for nonpoint source control.

- Where high-quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

Although the quality of water in the upper Sacramento River is relatively good, water quality problems do occur, including the presence of mercury, pesticides such as organochlorine pesticides, trace metals, turbidity, and toxicity from unknown origin (CALFED 2000a).

The CWA requires states to maintain a listing of impaired water bodies so that a TMDL can be established. A TMDL is a plan to restore the beneficial uses of a stream or to otherwise correct an impairment. The most prevalent contaminants in the Sacramento River basin are for organophosphate pesticides (agricultural runoff) and trace metals (acid mine drainage), for which TMDLs currently are being considered. Only during conditions of stormwater-driven runoff are water quality objectives typically not met (Domagalski et al. 2000).

Shasta-Trinity National Forest Land and Resource Management Plan

STNF is guided by various laws, regulations, and policies that provide the framework for all levels of planning. These include regional guides, the Shasta-Trinity National Forest Land and Resource Management Plan, and site-specific planning documents, such as this document.

The Shasta-Trinity National Forest Land and Resource Management Plan provides guidance for managing National Forest System lands in STNF. The development of a forest land and resource management plan (LRMP) occurs within the framework of regional and national USFS planning. The LRMP includes forest goals; forest objectives, including forest-wide prescription assignment by acres, outputs, and activities; and forest standards and guidelines. Forest goals state the management philosophy of the LRMP, and the Forest objectives describe the purpose of the management prescriptions. The Forest-wide management prescriptions apply a management theme to specific types of land (e.g., wilderness, roaded high-density recreation).

In essence, this LRMP requires that projects authorized by STNF be designed and implemented in a manner that maintains the existing conditions or implements actions to restore biological and physical processes within their natural range of variability.

Water Quality
Goals (LRMP, p. 4-6)

- Maintain or improve water quality and quantity to meet fish habitat requirements and domestic use needs.

- Maintain water quality to meet or exceed applicable standards and regulations.

Standards and Guidelines (LRMP, p. 4-25)

- Implement BMPs for protection or improvement of water quality, as described in "Water Quality Management for National Forest System Lands in California," for applicable management activities. Determine specific practices or techniques during project level planning using information obtained from on-site soil, water, and geology investigations.

Best Management Practices
Standards and Guidelines (LRMP, Appendix E)

- STNF water quality BMPs were developed in compliance with Section 208 of the Federal CWA, Public Law 92-500, as amended and are certified by the RWQCB and approved by EPA. The following BMPs are applicable to the proposed action:

Road Building and Site Construction
Standards and Guidelines (LRMP, Appendix E, pp. E-2 through E-3)

- General guidelines for the location and design of roads

- Erosion control plan

- Timing of construction activities

- Road slope stabilization (preventive practice)

- Road slope stabilization (administrative practice)
- Dispersion of subsurface drainage from cut and fill slopes
- Control of road drainage
- Construction of stable embankments
- Minimization of sidecast material
- Servicing and refueling equipment
- Control of construction in riparian management zones
- Controlling in-channel excavation
- Diversion of flows around construction sites
- Bridge and culvert installation
- Disposal of right-of-way and roadside debris
- Specifying riprap composition
- Maintenance of roads
- Road surface treatment to prevent loss of materials
- Traffic control during wet periods
- Surface erosion control at facility sites

Recreation
Standards and Guidelines (LRMP, Appendix E, p. E-3)

- Sampling and surveillance of designated swimming sites
- On-site interdisciplinary sanitary surveys will be conducted to augment the sampling of swimming waters
- Documentation of water quality data
- Control of sanitation facilities
- Control of refuse disposal
- Protection of water quality within developed and dispersed recreation areas

U.S. Bureau of Land Management

The U.S. Bureau of Land Management's Resource Management Plan, which is its plan for managing Federal lands in Shasta County, was amended by the 1994 Record of Decision (ROD) for the Northwest Forest Plan (Final Supplemental EIS for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl). This amendment required preparation of Watershed Analysis before initiating U.S. Bureau of Land Management activities. As a party to the Northwest Forest Plan, U.S. Bureau of Land Management, like USFS, is also required to ensure that projects are consistent with the Aquatic Conservation Strategy.

Biological Opinions on the Long-term Central Valley Project and State Water Project Operations Criteria and Plan

Since 2004, NMFS and USFWS BOs regarding effects of the proposed Operations Criteria and Plan (OCAP) have been revised twice. On October 22, 2004, NMFS issued a BO regarding effects of the proposed OCAP for the CVP in coordination with the SWP on winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Southern Oregon/Northern California Coast Coho salmon, and Central California Coast steelhead and their designated critical habitat. On February 16, 2005, USFWS issued a BO regarding effects of the proposed OCAP on delta smelt. The 2004 and 1995 BOs supersede the prior BOs issued by NMFS and USFWS, and contain reasonable and prudent measures and terms and conditions that specify fisheries monitoring actions, spawning gravel augmentation, forecasting of deliverable water, management of cold-water supply within reservoirs, temperature monitoring, adaptive management processes to analyze annual cold-water management, minimization of flow fluctuations, passage at Red Bluff Diversion Dam, operation of gates in the Delta, fish screening at pumping facilities, and numerous other effects minimization measures. In response to litigation, the 2004 and 2005 BOs were remanded to NMFS and USFWS for revision, but were not vacated.

In August 2008, Reclamation reinitiated consultation with the fishery agencies based on the 2008 *Biological Assessment on the Continued Long-Term Operations of the CVP and SWP* (2008 OCAP BA). In December 2008, the USFWS issued a new BO, *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the CVP and SWP,* finding that the long-term operations of the CVP and SWP would jeopardize the continued existence of the Delta smelt. In July 2009, NMFS issued a new BO finding that the same operations would jeopardize populations of listed salmonids, steelhead, green sturgeon and orcas. Because both agencies made jeopardy determinations, both agencies included a reasonable and prudent alternative (RPA) in their BOs.

In response to lawsuits challenging the 2008 and 2009 BOs, the District Court for the Eastern District of California (District Court) remanded the BOs to USFWS and NMFS in 2010 and 2011, respectively. The District Court ordered USFWS and Reclamation to prepare a final BO and associated final NEPA document by December 1, 2013. Similarly, the District Court ordered NMFS and Reclamation to prepare a final BO and associated final NEPA document by February 1, 2016. These legal challenges may result in changes in CVP and SWP operational constraints, if the revised USFWS and NMFS BOs contain new or amended RPAs. Despite this uncertainty, the 2008 OCAP BA and the 2008 and 2009 BOs issued by the fishery agencies contain the most recent estimate of potential changes in water operations that could occur in the near future. Furthermore, it is anticipated that the final BOs issued by the resource agencies will contain similar RPAs.

7.2.2 State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) is California's statutory authority for the protection of water quality. Under the act, the State must adopt water quality policies, plans, and objectives protecting the State's waters for the use and enjoyment of the people. Obligations of the SWRCB and RWQCBs to adopt and periodically update their basin plans are set forth in the act. A basin plan identifies the designated beneficial uses for specific surface water and groundwater resources, applicable water quality objectives necessary to support the beneficial uses, and implementation programs that are established to maintain and protect water quality from degradation for each of the RWQCBs. The act also requires waste dischargers to notify the RWQCBs of their activities through the filing of reports of waste discharge and authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements (WDR), NPDES permits, Section 401 water quality certifications, or other approvals. The RWQCBs also have authority to issue waivers to reports of waste discharge/WDRs for broad categories of "low threat" discharge activities that have minimal potential for adverse water quality effects when implemented according to prescribed terms and conditions.

The CVRWQCB Basin Plan (originally published in 1998, last revised in September 2009) (CVRWQCB 2009) regulates waters of the State located within the primary study area. The CVRWQCB Basin Plan covers an area including the Sacramento and San Joaquin river basins, involving an area bounded by the crests of the Sierra Nevada on the east and the Coast Ranges and Klamath Mountains on the west. The area covered in the CVRWQCB Basin Plan extends some 400 miles, from the California/Oregon border southward to the headwaters of the San Joaquin River, encompassing a substantial portion of the extended study area. The beneficial uses of the Sacramento River are as follows (CVRWQCB 2009):

- Municipal and domestic supply
- Irrigation and stock watering
- Service supply

- Power
- Contact recreation and canoeing and rafting
- Other noncontact recreation
- Freshwater habitat (warm and cold)
- Migration habitat (warm and cold)
- Spawning habitat (warm and cold)
- Wildlife habitat
- Navigation

The Basin Plan recognizes Shasta Reservoir (i.e., Shasta Lake) as a discrete water body and identifies a number of specific beneficial uses:

- Municipal and domestic supply
- Agricultural supply
- Hydropower generation
- Water contact recreation
- Noncontact recreation
- Freshwater habitat (warm and cold)
- Spawning, reproduction, and/or early development
- Wildlife habitat

The CVRWQCB has also promulgated water quality objectives for all surface waters in the Sacramento and San Joaquin River basins (CVRWQCB 2009) for the following:

- Bacteria levels
- Biostimulatory substances
- Chemical constituents
- Color
- Dissolved oxygen

- Floating material
- Methylmercury
- Oil and grease
- pH
- Pesticides
- Radioactivity
- Salinity
- Sediment
- Settleable material
- Suspended material
- Tastes and odors
- Temperature
- Toxicity
- Turbidity

Primary Study Area The CVRWQCB determined that the 25-mile reach of the Sacramento River from Keswick Dam downstream to Cottonwood Creek is impaired because the water periodically contains levels of dissolved cadmium, copper, and zinc that exceed levels identified to protect aquatic organisms. Consequently, the CVRWQCB developed a TMDL program for dissolved cadmium, copper, and zinc loading into the upper Sacramento River because of these exceedences of water quality standards (CVRWQCB 2002) and has proposed implementing the water quality objectives listed in Table 7-3 as numeric targets for this TMDL. No other TMDLs have been finalized for this area (CVRWQCB 2007a).

Table 7-3. Proposed TMDL Numeric Targets for Dissolved Cadmium, Copper, and Zinc for a 25-Mile Segment of the Upper Sacramento River between Keswick Dam and Cottonwood Creek near Balls Ferry in Shasta County

Metals	Acute Numeric Target (µg/L)	Chronic Numeric Target (µg/L)
Cadmium	0.22	0.22
Copper	5.6	4.1
Zinc	16	16

Source: CVRWQCB 2002

Key:
µg/L = micrograms per liter
TMDL = total maximum daily load

Extended Study Area The Sacramento River downstream from RBPP was listed as an impaired water body under Section 303(d) of the CWA. The parameters of concern in this reach included diazinon, mercury, and unknown sources of toxicity (CVRWQCB 2003b). TMDLs under development for the Sacramento River are for diazinon, methylmercury, and chlorpyrifos (CVRWQCB 2007b). The extended study area encompasses the San Francisco, Central Coast, Los Angeles, Lahontan, Colorado River basin, and the Santa Ana and San Diego RWQCBs.

Clean Water Act Section 401 Water Quality Certification

The CVRWQCB, under the auspices of the SWRCB, requires that a project proponent obtain a CWA Section 401 water quality certification in conjunction with the Section 404 permits granted by USACE. Because the project would have the potential to affect water quality in Shasta Lake, the CVRWQCB is likely to impose water quality limitations on the project through WDRs. Reclamation will prepare and submit to the CVRWQCB a request for water quality certification before development of the project. A likely condition of the water quality certification is preparation of an erosion and sedimentation control plan and a spill prevention and containment plan.

Waste Discharge Permit

The CVRWQCB controls the discharge of wastes to surface waters from industrial processes or construction activities through the NPDES permit process. WDRs are established in the permit to protect beneficial uses. The CVRWQCB will require an application for a waste discharge permit for the project.

Industrial Stormwater General Permit

The Industrial Stormwater General Permit (General Industrial Permit) is an NPDES permit that regulates discharges associated with 10 broad categories of industrial activities. This permit requires implementation of management measures that will achieve the performance standard of best available technology economically achievable and best conventional pollutant control technology. This permit also requires development of a SWPPP and a monitoring plan. Through the SWPPP, sources of pollutants are to be identified and the means to manage the sources to reduce stormwater pollution are described.

Stormwater Pollution Prevention Plan

The General Industrial Permit includes provisions for developing a SWPPP to maximize the potential benefits of pollution prevention and sediment- and erosion-control measures at construction sites. Developing and implementing a SWPPP would provide Reclamation with the framework for reducing soil erosion and minimizing pollutants in stormwater during project construction.

Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California

The Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan) sets limits for "thermal waste" and "elevated temperature waste" discharged into coastal and interstate waters and enclosed bays and estuaries of California (SWRCB no date). Estuarine waters are considered to extend from "…a bay or the open ocean to the upstream limit of tidal action" (SWRCB no date). This definition includes the Delta as defined by Section 12220 of the California Water Code, as well as portions of the Sacramento River that are subject to tidal action. Generally, the Basin Plan defines temperature objectives in two parts (CVRWQCB 2009):

> *At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.*
>
> *The temperature shall not be elevated above 56°F in the reach from Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery.*

The first water quality standards for the Delta were adopted in May 1967, when the State Water Rights Board (predecessor to the SWRCB) released Water Right Decision 1275 (D-1275), approving water rights for the SWP while setting agricultural salinity standards as terms and conditions. Since then, these requirements were changed in 1971 under Water Right Decision 1379 (D-1379), and again in 1978 under Water Right Decision 1485 and the Water Quality Control Plan (WQCP) for the Delta and Suisun Marsh (1978 WQCP). In May 1995, SWRCB adopted a new Bay-Delta WQCP, and it was implemented through SWRCB Revised Water Rights Decision 1641 (D-1641) in March 2000.

2006 Water Quality Control Plan

The 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB 2006b) established water quality control measures that contribute to the protection of beneficial uses in the Delta. The 2006 WQCP identified (1) beneficial uses of the Delta to be protected, (2) water quality objectives for the reasonable protection of beneficial uses, and (3) a program of implementation for achieving the water quality objectives. The 2006 WQCP superseded the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary adopted in May 1995 (1995 Bay-Delta Plan or 1995 Plan) as well as the preceding plans that the 1995 WQCP superseded (including the original 1978 WQCP and 1991 amended WQCP). Amendments made as part of the December 15, 1994, Bay-Delta Accord, which committed the CVP and SWP to new Delta habitat objectives. Because these new beneficial objectives and water quality standards were more protective than those of the previous Water Right Decision 1485, the new objectives were adopted by amendment in 1995 through a Water Rights Order for operation of the CVP and SWP. One key feature of the 1995 WQCP was the estuarine habitat (X2) objectives for Suisun Bay and the western Delta. The X2 objective required specific daily or 14-day surface EC criteria, or 3-day averaged outflow requirements to be met for a certain number of days each month, February through June. These requirements were designed to provide improved shallow water habitat for fish species in spring. Because of the relationship between seawater intrusion and interior Delta water quality, the X2 criteria also improved water quality at Delta drinking water intakes. Other new elements of the 1995 WQCP included export-to-inflow ratios intended to reduce entrainment of fish at the export pumps, Delta Cross Channel gate closures, and San Joaquin River EC and flow standards. Further amendments in 2006 updated the program of implementation in the 1995 WQCP, including adding direction and recommendations to other agencies regarding activities that the agencies should take to assist in achieving the objectives; and included several commitments and recommendations for studies and other activities.

Water Right Decision 1641

D-1641 and Water Rights Order 2001-05 contain the water right requirements to implement the 2006 WQCP. D-1641 incorporates water right settlement agreements between Reclamation and DWR and certain water users in the Delta and upstream watersheds regarding contributions of flows to meet water quality objectives. However, Reclamation and/or DWR are responsible for ensuring that objectives are met in the Delta. D-1641 also authorizes the CVP and SWP to use joint points of diversion (JPOD) in the south Delta, and recognizes the CALFED Operations Coordination Group process for operational flexibility in applying or relaxing certain protective standards. The additional exports allowed under the JPOD could result in additional degradation of water quality for water users in the south and central Delta. The JPOD also could affect water levels in the south Delta and endangered fish species.

In February 2006, SWRCB issued notice to Reclamation and DWR that each agency is responsible for meeting the objectives in the interior south Delta, as described in D-1641. The SWRCB order requires Reclamation and DWR to comply with a detailed plan and time schedule that will bring them into compliance with their respective permit and license requirements for meeting interior south Delta salinity objectives by July 1, 2009. The SWRCB order also revised the previously issued (July 1, 2005) Water Quality Response Plan approval governing Reclamation's and DWR's use of each other's respective point of diversion in the south Delta. Additionally, the order specifies that JPOD operations are authorized pursuant to the 1995 WQCP, and that Reclamation and DWR may conduct JPOD diversions, provided that both agencies are in compliance with all conditions of their respective water right permits and licenses at the time the JPOD diversions would occur (SWRCB 2006a).

Municipal and Industrial Water Quality Objectives

In the 1978 WQCP, the SWRCB set two objectives that it believed would provide reasonable protection for M&I beneficial uses of Delta waters from the effects of salinity intrusion. The first objective established a year-round maximum mean daily chloride concentration measured at five Delta intake facilities, including CCWD's Pumping Plant Number 1, of 250 mg/L for the reasonable protection of municipal beneficial uses. This objective was consistent with the EPA secondary maximum contaminant level for chloride of 250 mg/L, and is based only on aesthetic (taste) considerations. The second objective established a maximum mean daily chloride concentration of 150 mg/L (measured at either CCWD Pumping Plant No. 1 or the San Joaquin River at the Antioch water works intake) for the reasonable protection of industrial beneficial uses (specifically manufacture of cardboard boxes by Gaylord Container Corporation in Antioch). This requirement is in effect for a minimum of between 155 and 240 days each calendar year, depending on the water year type.

In the 1991 WQCP, the SWRCB reviewed the water quality objectives for M&I use contained in the 1978 WQCP, and reviewed potential new objectives for trihalomethanes and other disinfection byproducts, including bromides. The SWRCB concluded that technical information regarding trihalomethanes and other disinfection byproducts was not sufficient to set a scientifically sound objective. Accordingly, the SWRCB continued the existing objectives for chloride concentration, and until development of more information about these constituents, set a water quality "goal" for bromides of 0.15 mg/L (150 micrograms per liter). The SWRCB also noted that the 150 mg/L chloride objective was maintained in part because it provides ancillary protection for other M&I uses in the absence of objectives for trihalomethanes and other disinfection byproducts.

These objectives remained unchanged in the 1995 and 2006 WQCPs. The SWRCB and CVRWQCB basin plans specify water quality objectives to protect designated beneficial uses, including municipal drinking-water supply. The

CVRWQCB is also currently developing a Central Valley drinking-water policy that may lead to regulations limiting the discharge of bromide, organic carbon, pathogens, and other drinking water constituents of concern. The CVRWQCB took the important step of adopting resolutions in July 2004 (Resolution No. R5-2004-0091) and July 2010 (Resolution No. R5-2010-0079), supporting development of the policy. Resolution No. R5-2010-0079 directed CVRWQCB staff to develop and bring a comprehensive drinking water policy to the board within 3 years (i.e., by 2013).

Coordinated Operations Agreement

The Coordinated Operations Agreement defines how Reclamation and DWR share their joint responsibility to meet Delta water quality standards and meet the water demands of senior water right holders. The Coordinated Operations Agreement defines the Delta as being in either “balanced water conditions” or “excess water conditions.” Balanced conditions are periods when Delta inflows are just sufficient to meet water user demands within the Delta, outflow requirements for water quality and flow standards, and export demands. Under excess conditions, Delta outflow exceeds the flow required to meet the water quality and flow standards. Typically, the Delta is in balanced water conditions from June to November, and in excess water conditions from December through May. However, depending on the volume and timing of winter runoff, excess or balanced conditions may extend throughout the year.

During excess water conditions, but during periods when Delta outflow is still relatively low, additional Delta diversions can degrade the water quality needed to meet drinking water standards, even when SWRCB M&I objectives are being met.

7.2.3 Local

The primary study area is located within both Shasta and Tehama counties, while the extended study area includes the following counties: Glenn, Butte, Colusa, Sutter, Yolo, Yuba, Sacramento, Napa, Solano, San Francisco, Contra Costa, San Joaquin, Alameda, Santa Clara, Stanislaus, Santa Cruz, San Benito, Merced, Madera, Fresno, Tulare, King, Kern, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, San Diego, and Imperial. Each of these counties has a general plan that includes general policies to protect water quality, water supply, water resources, and watersheds. No specific local requirements are pertinent to this analysis.

Water quality protection measures are included in the *Shasta County General Plan*. The county’s goal is to protect all aspects of water quality in the county. The county defines erosion and downstream sedimentation as geologic hazards that must be prevented as part of grading and site development. The Shasta County Grading Ordinance sets requirements for grading and erosion control, including prevention of sedimentation or damage to off-site property. Grading permits require a vested map and the following information:

- A detailed grading plan
- Geological studies, if the project is located within an area that is prone to slippage, or has highly erodible soils or known geologic hazards
- Detailed drainage or flood control information as required by the Department of Public Works
- A final development plan, if the project is located in a zone or district that requires a final development plan
- A noise analysis, if the project is located in the vicinity of a high-noise-generating use

The water quality protection goal included in the Open Space and Conservation Element of the Tehama County General Plan (Tehama County 2009) is to ensure that water supplies are of sufficient quality and quality, now and into the future, to serve the needs of Tehama County (Goal OS-1). Policies in support of this goal include sound watershed management, protection of surface water quality and streamflows, and protection of groundwater quality through the minimization of erosion and prevention of intrusion of wastes into water supplies.

7.3 Environmental Consequences and Mitigation Measures

7.3.1 Methods and Assumptions

A combination of water quality monitoring data and computer modeling was used to aid in the evaluation of potential impacts of the project alternatives on water quality. Anticipated construction practices and materials, location, and duration of construction were also evaluated.

To evaluate potential Delta water quality impacts, the analysis relied on quantitative modeling tools to simulate conditions that would be expected to occur under the SLWRI alternatives compared to the bases of comparison (i.e., existing conditions without project, and future conditions without project). The analysis of potential impacts on water quality in the Delta includes an analysis of potential impacts on water quality for all in-Delta water users. Delta parameters used in the evaluation include simulated changes in X2 location, Delta outflow, export-to-inflow ratio, salinity, and chloride ion concentrations.

The water quality impact assessment focuses on EC, measured in millimhos per centimeter (mmhos/cm), and chloride ion concentration in mg/L, as indicators of Delta water quality because they are the primary water quality constituents most likely to be affected by changes in Delta outflow and pumping operations. EC also is the parameter for which considerable monitoring data are available, and which has been used to calibrate the modeling tools used to simulate Delta water quality conditions.

A suite of modeling tools was used to evaluate the potential impacts of existing conditions, and the No-Action and other SLWRI alternatives on the Delta water quality of the project, and to quantify potential benefits. The California Water Resources Simulation Model II (CalSim-II) model, SLWRI 2012 Benchmark Version, was used to simulate CVP and SWP operations, determining the surface water flows, storages, and deliveries associated with each alternative. CalSim-II is a specific application of the Water Resources Integrated Modeling System (WRIMS) to simulate CVP and SWP water operations. A detailed description of CalSim-II is included in Chapter 2 of the Modeling Appendix. Delta Simulation Model 2 (DSM2) was used to simulate the hydrodynamics of the Delta, providing the data used in discussion of the water-quality-related impacts of each alternative. (A detailed description of DSM2 and the assumptions used in the SLWRI analysis are included in Chapter 7 of the Modeling Appendix.) Summaries of the analysis and modeling results are provided below. (More detailed results of the CalSim-II output can be found in Attachment 1 of the Modeling Appendix.) Attachment 17 of the Modeling Appendix contains more detailed DSM2 output.

To understand the effects of the alternatives under both existing and future conditions, each alternative was modeled using two different assumptions about level of development (i.e., 2005 and 2030) and compared to the appropriate baseline modeling results to determine the character and extent of impacts.

CalSim-II

CalSim-II is the application of the Water Resources Integrated Modeling System software to the CVP/SWP. This application was jointly developed by Reclamation and DWR for planning studies relating to CVP/SWP operations. The primary purpose of CalSim-II is to evaluate the water supply reliability of the CVP and SWP at current or future levels of development (e.g., 2005, 2030), with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the drainage basin of the Delta, and CVP/SWP exports to the Bay Area, San Joaquin Valley, Central Coast, and Southern California.

CalSim-II typically simulates system operations for an 82-year period using a monthly time step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed level of development (e.g., 2005, 2030). The historical flow record of October 1921 to September 2003, adjusted for the influences of land use changes and upstream flow regulation, is used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CalSim-II uses a mass balance approach to route water through this network. Simulated flows are mean flows for the month; reservoir storage volumes correspond to end-of-month storage.

CalSim-II models a complex and extensive set of regulatory standards and operations criteria. (Descriptions of both are contained in Chapter 2 of the Modeling Appendix.) The hydrologic analysis for this DEIS used SLWRI 2012 Benchmark Version CalSim-II model, which is the best available hydrological modeling tools, to approximate the changes in storage, flow, salinity, and reservoir system reoperation associated with the SLWRI alternatives. Although CalSim-II is the best available tool for simulating system-wide operations, the model also contains simplifying assumptions in its representation of the real system.

A general external review of the methodology, software, and applications of CalSim-II was conducted in 2003 (Close et al. 2003). Recently, an external review of the San Joaquin River Valley CalSim-II model was also conducted (Ford et al. 2006). Several limitations of the CalSim-II model were identified in these external reviews. The main limitations of the CalSim-II model are as follows:

- Model uses a monthly time step
- Accuracy of the inflow hydrology is uncertain:
  - Model lacks a fully explicit groundwater representation

Reclamation, DWR, and the external reviewers have identified the need for a comprehensive error and uncertainty analysis for various aspects of the CalSim-II model. DWR has issued a CalSim-II Model Sensitivity Analysis Study (DWR 2005), and Reclamation is currently embarking on a similar sensitivity and uncertainty analysis for the San Joaquin River basin. This information will improve understanding of the model results.

Despite these limitations, the monthly CalSim-II model results remain useful for comparative purposes. It is important to differentiate between “absolute” or “predictive” modeling applications and “comparative” applications. In “absolute” applications, the model is run once to predict a future outcome and errors or assumptions in formulation, system representation, data, operational criteria, etc., all contribute to total error or uncertainty in model results. In “comparative” applications, the model is run twice, once to represent a base condition (No-Action Alternative) and a second time with a specific change (project) to assess the change in the outcome because of the input change. In this mode (the mode used for this DEIS), the difference between the two simulations is of principal importance. Potential errors or uncertainties that exist in the “no-project” simulation are also present in the “project” simulation such that their impacts are reduced when assessing the change in outcomes. The SLWRI analysis is a comparative analysis.

DSM2

DSM2 is a branched 1-dimensional model for simulation of hydrodynamics, water quality, and particle tracking in a network of riverine or estuarine channels (DWR 2002). The hydrodynamic module can simulate channel stage, flow, and water velocity. The water quality module can simulate the movement of both conservative and nonconservative constituents. The model is used by DWR to perform operational and planning studies of the Delta.

Impact analyses for planning studies of the Delta are typically performed for an 82-year period (1922 to 2003). In model simulations, EC is typically used as a surrogate for salinity. Results from CalSim-II are used to define Delta boundary inflows. CalSim-II-derived boundary inflows include the Sacramento River flow at Hood, San Joaquin River flow at Vernalis, inflow from the Yolo Bypass, and inflow from the eastside streams. In addition, Net Delta Outflow from CalSim-II is used to calculate the salinity boundary at Martinez.

Details of the model, including source codes and model performance, are available from the DWR Bay-Delta Office, Modeling Support Branch Web site (http://modeling.water.ca.gov/delta/models/dsm2/index.html). Documentation on model development is discussed in annual reports on Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh submitted to the SWRCB by the DWR Delta Modeling Section.

Sediment

The potential impacts from sediment in terms of erosion and geomorphology are analyzed in Chapter 4, “Geology, Geomorphology, Minerals, and Soils.”

Temperature

The analysis presented in Chapter 6, “Hydrology, Hydraulics, and Water Management,” assumed that the SLWRI alternatives would not alter existing operational rules or protocols and that there would be no formal changes to CVP or SWP operating criteria. Each action alternative would include storing some additional flows behind Shasta Dam during periods when the flows would have otherwise been released downstream. The resulting increase in storage would be used both to create an expanded cold-water pool (CWP), thus benefiting fisheries, and for subsequent release downstream when opportunities would exist to put the water to beneficial use.

HEC-5Q temperature modeling was used to simulate flow and temperature for the Sacramento River system above Red Bluff. This model was updated to better represent the upper Sacramento River system with an emphasis on operation of the Shasta TCD. CalSim-II results were used as flow inputs to the HEC-5Q model. Temperature results are presented in Chapter 11, “Fisheries and Aquatic Resources.” The water quality impacts analysis for temperature based on those results is summarized below.

Metals

Water quality data available for Shasta Lake and its tributaries were used to assess the impacts related to the discharge of metals into Shasta Lake. Available monitoring data for the Sacramento River were used to assess the impacts of metals in Keswick Reservoir and the Sacramento River downstream.

7.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

Overall Impact Indicators for Water Quality

The significance criteria described below were developed based on guidance provided by the State CEQA Guidelines for use in assessing potential impacts on water quality; they also consider the context and intensity of the environmental effects as required under NEPA. These significance criteria were applied to the qualitative assessment and quantitative modeling results and used to determine impact significance. The analysis of water quality impacts and benefits focuses on temperature, metals, and sediment, because they are important water quality constituents in the both the primary and extended study areas.

The impact significance criteria for Delta water quality variables that have regulatory objectives or numerical standards, such as those contained in the 2006 WQCP, are developed from the general considerations listed below.

Impacts of an alternative on water quality would be significant if project implementation would do any of the following:

- Violate existing water quality standards or otherwise substantially degrade water quality
- Result in substantial water quality changes that would adversely affect beneficial uses
- Result in substantive undesirable impacts on public health or environmental receptors

Significance statements are relative to both existing conditions (2005) and future conditions (2030) unless stated otherwise.

Impact Indicators for Delta Salinity

If changes in salinity within the Delta during months of increased pumping would result in an increase in salinity, relative to the basis of comparison, of sufficient frequency and magnitude over the long term to adversely affect designated beneficial uses, to increase the frequency that existing regulatory standards are exceeded, or to substantially degrade water quality at the locations below, then the impact would be considered significant:

- Sacramento River at Collinsville
- San Joaquin River at Jersey Point
- Sacramento River at Emmaton
- Old River at Rock Slough
- Delta-Mendota Canal at Jones Pumping Plant
- West Canal at mouth of the Clifton Court Forebay
- San Joaquin River at Vernalis
- Old River near Tracy Road Bridge
- Old River at Middle River
- San Joaquin River at Brandt Bridge

Figure 7-3 shows the major Delta islands, waterways, water quality control stations, and M&I intakes within the Delta.

Salinity Salinity-related water quality impacts associated with the operational component of the SLWRI alternatives were assessed at several locations in the Delta. EC was used as a surrogate for salinity. Using the assumptions discussed above, and detailed in Chapter 7 of the Modeling Appendix, the DSM2 model calculated changes in monthly mean EC values for the alternatives, relative to the bases of comparison. Monthly EC results were derived for an 82-year simulation period, extending from 1922 through 2003.

DSM2 model output was used to evaluate potential changes in salinity under the SWLRI alternatives, relative to the bases of comparison: changes equal to or greater than 5 percent in long-term monthly average EC values and average monthly EC values by water year type, and compliance with water quality standards, including the number of occurrences during which an EC compliance standard was met or exceeded.

Node ID	Description
1	Sacramento River at Rio Vista
2	Sacramento River at Emmaton
3	Sacramento River at Collinsville
4	Sacramento River at Chipps Island
5	Sacramento River at Port Chicago (Roe Island)
6	Old River near Middle River
7	Old River at Tracy Road Bridge
8	Delta Mendota Canal at Tracy Pumping Plant
9	West Canal at mouth of Clifton Court Forebay Intake
10	Old River at CCWD Los Vaqueros Intake
11	CCWD Proposed Alternative Intake
12	Middle River east of Victoria Island
13	Woodward Canal
14	Old River at Rock Slough
15	Contra Costa Canal at Pumping Plant #1
16	San Joaquin River near Vernalis
17	San Joaquin River at Brandt Bridge
18	San Joaquin River downstream of Calaveras River
19	Stockton Proposed Intake
20	San Joaquin River at Prisoners Point
21	San Joaquin River at San Andreas Landing
22	San Joaquin River at Jersey Point
23	San Joaquin River at Antioch Ship Channel
24	Mokelumne River at Terminous
25	Barker Slough at North Bay Aqueduct Intake
26	Head of Old River Barrier
27	Middle River Barrier
28	Grant Line Canal Barrier
29	Old River Barrier at Tracy Road Bridge

Figure 7-3. Major Delta Islands, Waterways, Water Quality Control Stations, and Municipal and Industrial Intakes

Changes in salinity were evaluated in the Delta during months of increased pumping under the alternatives, relative to the bases of comparison. Potential significant impacts could occur if salinity increases were of sufficient frequency and magnitude over the long term to adversely affect designated beneficial uses, to exceed existing regulatory standards, or to substantially degrade water quality.

Delta water quality is directly controlled by existing Delta water quality objectives (SWRCB 1995) for M&I, agricultural, and fish and wildlife uses that are incorporated in SWRCB D-1641 (SWRCB 2000). The 2006 WQCP objectives vary with month and water year type. Also, the 2006 WQCP objectives may only apply for some months and at some locations.

Applicable EC objectives were evaluated for the agricultural diversion season of April through August at Emmaton and Jersey Point, and during the entire year at each of the CVP/SWP export locations, and three south Delta locations. Increases in EC values that result in exceedence of the objective at specified locations in the Delta were considered to be significant water quality impacts. Monthly changes in EC values are also considered to be significant if they exceeded 10 percent of the applicable objective.

Impact Indicators for X2 Position

If a change in mean monthly position of X2, relative to the bases of comparison, would be of sufficient frequency and magnitude to adversely affect water quality, then it will be considered a significant impact.

The X2 parameter represents the geographical location of the 2 parts per thousand near-bottom salinity isohaline in the Delta, which is measured in distance upstream from the Golden Gate Bridge in Suisun Bay (Jassby et al. 1995). The location of the estuarine salinity gradient is regulated during the months of February through June by the location of the X2 objective in the 2006 WQCP. During this time period, the X2 location must remain downstream from the confluence of the Sacramento and San Joaquin rivers at Collinsville for the entire 5-month period. The X2 objective also specifies the number of days each month that that location of X2 must be downstream from Chipps Island or downstream from Roe Island (also referred to as the Port Chicago EC monitoring station).

Estuarine EC objectives (i.e., X2) specified in the 2006 WQCP are applicable at Chipps Island during February through June for most years. The maximum EC objective at Chipps Island is 2.640 mmhos/cm (corresponding to a 2 parts per thousand salinity at Chipps Island) and must be satisfied for a specified number of days each month, depending on the previous month’s Eight River Index (a measure of runoff in the Sacramento and San Joaquin valleys).

7.3.3 Topics Eliminated from Further Consideration

The comprehensive plans include measures to remove or abandon on-site wastewater treatment facilities (e.g., septic tanks and/or drain fields) in conjunction with relocation activities. Several wastewater treatment packages will be developed to ensure that management of effluent from lakeshore developments is consistent with requirements of Federal, State, and local agencies. Only minor project-related effects on nutrients are expected to occur in either the primary study area or the extended study area; therefore, potential effects on the study areas related to nutrients are not discussed further in this DEIS.

7.3.4 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, the Federal Government would take reasonably foreseeable actions, as defined above, but would take no additional action toward implementing a specific plan to help increase anadromous fish survival in the upper Sacramento River, nor help address the growing water reliability issues in California. Shasta Dam would not be modified, and the CVP would continue operating similar to the existing condition. Changes in regulatory conditions and water supply demands would result in differences in flows on the Sacramento River and at the Delta between existing and future conditions.

Shasta Lake and Vicinity

Impact WQ-1 (No-Action): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no construction activities would occur. Therefore, there would be no short-term increases in turbidity and suspended sediment in Shasta Lake and tributary streams that would cause violations of water quality standards or adversely affect beneficial uses. Ongoing impacts of sediment on beneficial uses would remain consistent with those that occur periodically under baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-2 (No-Action): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities associated with raising Shasta Dam would be constructed; therefore, no short-term changes in the temperature regime of waters within Shasta Lake or its tributaries would occur. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-3 (No-Action): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action

Alternative, no new facilities associated with raising Shasta Dam would be constructed in the vicinity of Shasta Lake; therefore, no construction-related metal effects would occur in Shasta Lake or tributary streams that would cause violations of water quality standards or adversely affect beneficial uses. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-4 (No-Action): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Under the No-Action Alternative, the operation of Shasta Dam would continue to influence the amount and duration of exposed shoreline below the maximum elevation of the reservoir, and sediment would continue to periodically be transported into Shasta Lake from tributaries. Therefore, sediment and turbidity would remain consistent with baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

As described in Chapter 4, “Geology, Geomorphology, Minerals, and Soils,” the shoreline would continue to erode, and impacts to beneficial uses, namely recreation and to some extent, the warm-water fishery along the shoreline of Shasta Lake, would be ongoing. In addition to active areas of shoreline erosion, sediment would continue to periodically be transported into Shasta Lake from tributaries as a result of other ongoing actions within the project area. Wave action and nearshore currents would continue to remobilize sediment that is typically visible as turbid plumes of water along portions of the shoreline. Sediment and turbidity would remain consistent with baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-5 (No-Action): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Under the No-Action Alternative, Shasta Dam would continue to be operated consistent with current regulatory requirements with respect to storage and release of water to the upper Sacramento River. Therefore, there would be no change in the temperature regime of waters within Shasta Lake or its tributaries. Periodic changes in water temperature on a seasonal or interannual basis would be consistent with those that occur under baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Reclamation operates the Shasta Dam TCD to manage water temperatures in the upper Sacramento River to (1) improve habitat for the endangered winter-run Chinook salmon and other threatened runs; (2) withdraw warmer surface water in the winter and spring to preserve cold-water storage for release during the temperature operation season; and (3) enable power generation to continue while controlling release temperatures, thereby eliminating the need to bypass the power plant penstocks via the low-level river outlets. Generally, to accomplish these temperature objectives during the temperature operation season, the TCD functions to select water temperatures in the 47°F to 52°F range. Therefore, a good index of the temperature-related benefits of the alternative is the volume of the CWP with a water temperature lower than 52°F at the end of April.

Under the No-Action Alternative, Shasta Dam would continue to be operated consistent with current regulatory requirements with respect to storage and release of water to the upper Sacramento River. As described in Chapter 6, "Hydrology, Hydraulics, and Water Management," the temperature profile within Shasta Lake would not be changed under the No-Action Alternative. Therefore, there would be no change in the temperature regime of waters within Shasta Lake or its tributaries. Periodic changes in water temperature on a seasonal or interannual basis would be consistent with those that occur under baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-6 (No-Action): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Under the No-Action Alternative, metal concentrations in the Main Body and the Squaw Creek Arm of Shasta Lake would continue to be within the range of variability that currently exists with respect to the ongoing discharge and potential storage of heavy metals associated with historic mining and smelting operations. Concentrations of metals, specifically copper and zinc that may persist within the water column of Shasta Lake would continue to remain in suspension at locations and levels similar to baseline conditions. Ongoing remediation of historic mining properties at locations in the Dry Creek, Little Backbone, Squaw Creek, and Horse Creek watersheds are anticipated to reduce the amount of acid mine drainage into Shasta Lake over time, thereby reducing metal concentrations in the water column. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (No-Action): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities would be constructed at Shasta Lake; thus there would be no construction-related sediment effects on the upper Sacramento River that would cause violations of water quality standards or adversely affect beneficial uses. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-8 (No-Action): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities associated with raising Shasta Dam would be constructed; therefore, no short-term changes in the temperature regime of waters within the upper Sacramento River would occur. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-9 (No-Action): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities associated with raising Shasta Dam would be constructed; therefore, no construction-related metal effects would occur in the upper Sacramento River that would cause violations of water quality standards or adversely affect beneficial uses. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-10 (No-Action): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Under the No-Action Alternative, the operation of Shasta Dam would continue to influence the amount and duration of sediment transported from Shasta Lake into the upper Sacramento River. Analysis of flow modeling results indicates little change in flows on the upper Sacramento River between existing conditions and the future No-Action Alternative conditions. Therefore, sediment and turbidity would remain similar to baseline conditions. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact WQ-11 (No-Action): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River under the No-Action Alternative, ongoing operations to meet existing regulatory requirements would be continued. The ability to comply with existing temperature requirements would not be improved. Analysis of temperature modeling results indicates little change in compliance with temperature objectives on the upper Sacramento River between existing conditions and the future No-Action Alternative conditions. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact WQ-12 (No-Action): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Under the No-Action Alternative, ongoing remediation of historic mining properties at locations in the Dry Creek, Little Backbone, Squaw Creek, and Horse Creek watersheds are anticipated to reduce the amount of acid mine drainage into Shasta Lake over time, thereby reducing metal concentrations in the water column.. Therefore, no long-term metals effects would occur that would cause violations of water quality standards or adversely affect beneficial uses in the upper Sacramento River. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact WQ-13 (No-Action): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no construction activities would occur. Therefore, there would be no short-term increases in turbidity and suspended sediment in the extended study area that would cause violations of water quality standards or adversely affect beneficial uses. Ongoing impacts of sediment on beneficial uses would remain consistent with those that occur periodically under baseline conditions. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-14 (No-Action): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities associated with raising Shasta Dam would be constructed; therefore, no short-term changes in the temperature regime of waters within the extended study area would occur. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-15 (No-Action): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under the No-Action Alternative, no new facilities associated with raising Shasta Dam would be constructed; therefore, no construction-related metal effects would occur in the extended study area that would cause violations of water quality standards or adversely affect beneficial uses. No impact would occur. Mitigation is not required for the No-Action Alternative.

Impact WQ-16 (No-Action): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Modeling results have indicated that flows in the Sacramento River would change little between existing conditions and the future No-Action Alternative conditions. Therefore, under the No-Action Alternative sediment and turbidity would remain similar to baseline conditions. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact WQ-17 (No-Action): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Analysis of temperature modeling shows little to no change in compliance with temperature objectives on the upper Sacramento River. This suggests that there would be little or no changes in temperature in the extended study area as a result of the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact WQ-18 (No-Action): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Under the No-Action Alternative, ongoing remediation of historic mining properties at locations in the Dry Creek, Little Backbone, Squaw Creek, and Horse Creek watersheds are anticipated to reduce the amount of acid mine drainage into Shasta Lake over time, thereby reducing metal concentrations in the water column.. Therefore, no long-term metals effects would occur that would cause violations of water quality standards or adversely affect beneficial uses in the extended study area. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Salinity The No-Action Alternative would differ from the Existing Conditions primarily through changes in regulatory conditions and water supply demands. Potential impacts, which are evaluated below, include changes in the following:

- Delta salinity on the Sacramento River at Collinsville
- Delta salinity on the San Joaquin River at Jersey Point
- Delta salinity on the Sacramento River at Emmaton
- Delta salinity on the Old River at Rock Slough
- Delta water quality on the Delta-Mendota Canal at Jones Pumping Plant
- Delta water quality on the West Canal at the mouth of the Clifton Court Forebay
- Delta salinity on the San Joaquin River at Vernalis
- Delta salinity on the San Joaquin River at Brandt Bridge
- Delta salinity on the Old River near the Middle River
- Delta salinity on the Old River at Tracy Road Bridge
- X2 position

Impact WQ-19a (No-Action): Delta Salinity on the Sacramento River at Collinsville The No-Action Alternative would result in both increases and decreases in salinity in comparison with baseline conditions; however, none of the increases would be sufficient to result in any violations of the salinity standards for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 6 percent. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

The water quality requirement on the Sacramento River at Collinsville is specified in D-1641, and is defined for all year types,[1] from October through April. The D-1641 objectives for the Sacramento River at Collinsville are defined in Table 7-4.

Table 7-4. D-1641 Water Quality Objectives for the Sacramento River at Collinsville

Months	Year-Type	Value (mmhos/cm)
October	All	19.0
November–December	All	15.5
January	All	12.5
February–March	All	8.0
April–May	All	11.0

Source: SWRCB 2000

Notes:
Year types defined by Sacramento Valley Index.
The requirement is the maximum monthly average of daily high tide EC values or demonstration that equivalent or better protection will be provided at the location.

Key:
D-1641 = Revised Water Right Decision 1641
EC = electrical conductivity
mmhos/cm = millimhos per centimeter (unit of EC)

As shown in Table 7-5, the No-Action Alternative would result in both increases and decreases in salinity as compared with baseline conditions; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 6 percent. Table 7-6 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Collinsville in the period of simulation. The No-Action Alternative would not result in any violations of the salinity standards for the Sacramento River at Collinsville. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

[1] Water year types are defined according to the Sacramento Valley Index Water Year Hydrologic Classification unless specified otherwise.

Table 7-5. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Collinsville Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	6.0	0.0 (0.1%)	7.1	0.1 (1.0%)
November	5.1	0.0 (0.0%)	6.8	0.1 (1.6%)
December	3.6	0.0 (-1.1%)	5.5	0.0 (-0.5%)
January	1.8	-0.1 (-3.1%)	3.4	-0.1 (-3.3%)
February	0.8	0.0 (-3.1%)	1.7	-0.1 (-3.4%)
March	0.6	0.0 (-1.1%)	1.2	0.0 (-1.3%)
April	0.7	0.0 (0.9%)	1.4	0.0 (2.1%)
May	1.1	0.0 (3.9%)	2.3	0.1 (5.7%)
June	2.2	0.0 (2.1%)	4.0	0.1 (2.9%)
July	3.2	0.1 (2.2%)	5.3	0.2 (3.2%)
August	5.3	0.1 (1.1%)	7.3	0.1 (1.0%)
September	5.2	0.0 (0.2%)	8.8	0.0 (0.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)
Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.
Key:
mmhos/cm = millimhos per centimeter

Table 7-6. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Collinsville Under the Existing Condition and No-Action Alternative

Month	Existing Condition (2005)			
	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19b (No-Action): Delta Salinity on the San Joaquin River at Jersey Point the No-Action Alternative would result in both increases and decreases in salinity in comparison with baseline conditions; however, none of the increases would be sufficient to change compliance for the San Joaquin River at Jersey Point on a long-term basis. On a percentage basis, all increases in salinity would be less than 4 percent. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

The water quality requirement on the San Joaquin River at Jersey Point is specified in D-1641 as two components. The first component of the requirement begins on April 1, and extends through a year-type–dependent date. The second component of the Jersey Point requirement begins at the end of the first component, and ends on August 15. The numerical requirement of the second component is dependent on the year type. Objectives for the San Joaquin River at Jersey Point are defined in Table 7-7.

Table 7-7. D-1641 Water Quality Objectives for the San Joaquin River at Jersey Point

Year Type	0.45 EC April 1 to the Date Shown	EC from Date Shown to August 15 (mmhos/cm)
Wet	August 15	0.45
Above Normal	August 15	0.45
Below Normal	June 20	0.74
Dry	June 15	1.35
Critical	April 1	2.20

Source: SWRCB 2000.

Note:
Year types defined by Sacramento Valley Index. Although requirement in D-1641 is the maximum 14-day running average of mean daily EC, modeling uses a monthly average.

Key:
D-1641 = Water Right Decision 1641
EC = electrical conductivity
mmhos/cm = millimhos per centimeter

Table 7-8 shows simulated monthly average salinity and percent change for the San Joaquin River at Jersey Point. On an average monthly basis EC requirements would be satisfied in all months in an average year under the No-Action Alternative. Furthermore, all increases in EC during April through August would be less than 4 percent. Table 7-9 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Jersey Point in the period of simulation. The No-Action Alternative would result in an increase in the frequency of violations under Existing Conditions. Violations occur during June, July, and August and are greatest in August, when violations would be approximately 30 percent for all years and 38 percent during dry and critical years. The long-term and dry-year average EC values in April and May are found to be below the standards, which indicate the violation is marginal and does not show any significant changes in water quality. In June, the long-term average dry-year values would increase from 0.4 mmhos/cm to 0.5 mmhos/cm. In June of critical years and July of both dry and critical years, the long-term average would remain above the standards and would not change from the Existing Condition. In August and September of dry years, EC would decrease on a long-term average, and remain above the standards and unchanged in critical years.

Overall, the frequency of exceedence of salinity standards for the San Joaquin River at Jersey Point under the No-Action Alternative would be similar to those under Existing and Future conditions. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-8. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Jersey Point Under the Existing Condition and No-Action Alternative

	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	**No-Action Alternative (mmhos/cm)**	**Existing Condition (mmhos/cm)**	**No-Action Alternative (mmhos/cm)**
October	1.6	0.0 (-0.9%)	1.8	0.0 (0.9%)
November	1.5	0.0 (-0.2%)	1.8	0.0 (2.4%)
December	1.2	0.0 (-1.0%)	1.8	0.0 (-0.6%)
January	0.7	0.0 (-4.0%)	1.1	-0.1 (-5.4%)
February	0.3	0.0 (-2.9%)	0.5	0.0 (-4.4%)
March	0.3	0.0 (-1.6%)	0.3	0.0 (-1.9%)
April	0.3	0.0 (-0.7%)	0.3	0.0 (0.8%)
May	0.3	0.0 (0.1%)	0.4	0.0 (3.9%)
June	0.4	0.0 (1.7%)	0.7	0.0 (3.7%)
July	1.0	0.0 (0.4%)	1.7	0.0 (0.5%)
August	1.6	0.0 (0.3%)	2.2	0.0 (-1.6%)
September	1.9	0.0 (0.8%)	2.8	0.0 (-0.6%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Key:
mmhos/cm = millimhos per centimeter

Table 7-9. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Jersey Point Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)
June	10	3.0 (30.0%)	8	3.0 (37.5%)
July	51	-1.0 (-2.0%)	22	-1.0 (-4.5%)
August	73	3.0 (4.1%)	25	2.0 (8.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19c (No-Action): Delta Salinity on the Sacramento River at Emmaton. The No-Action Alternative would result in both increases and decreases in salinity in comparison to baseline conditions; however, changes in salinity would not affect compliance with the standard as the Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Similar to the water quality requirement on the San Joaquin River at Jersey Point, the water quality requirement on the Sacramento River at Emmaton is specified in D-1641 as two components. The first component of the requirement begins on April 1, and extends through a year-type-dependent date. The second component of the Emmaton requirement begins at the end of the first component, and ends on August 15. The numerical requirement of the second component is dependent on the year type. Objectives for the Sacramento River at Emmaton are defined in Table 7-10.

Table 7-10. D-1641 Water Quality Objective for the Sacramento River at Emmaton

Year Type	0.45 EC April 1 to the Date Shown	EC from Date Shown to August 15 (mmhos/cm)
Wet	August 15	0.45
Above Normal	July 1	0.63
Below Normal	June 20	1.14
Dry	June 15	1.67
Critical	April 1	2.78

Source: SWRCB 2000

Note:
Year types defined by Sacramento Valley Index. Although requirement in D-1641 is the maximum 14-day running average of mean daily EC, modeling uses a monthly average.

Key:
D-1641 = Water Right Decision 1641
EC = electrical conductivity
mmhos/cm = millimhos per centimeter

Although Table 7-11 shows the EC for all months, the Emmaton water quality requirement is only defined for April 1 through August 15. On an average monthly basis, no change in the ability to meet EC requirements would occur in all months in an average year under the No-Action Alternative. Maximum change in monthly EC would not be greater than 6.8 percent. Table 7-12 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Emmaton in the period of simulation. The No-Action Alternative would result in an increase in the frequency of violations under during April, May, and July of dry and critical years, and in July and August on average for all year types. The modeled potential violations shown in Table 7-12 are most likely caused by a mismatch between the CalSim-II operations model and the DSM2 Delta hydrodynamics and mixing model, and are not caused by water operations in the Delta. Modeled standards violations caused by mismatches between DSM2 and CalSim-II occur because CalSim-II's monthly time step is not well-suited to handling daily or 14-day standards, or running average standards that span more than 1 month, such as those evaluated here. Furthermore, CalSim-II uses empirical approximations for estimating Delta salinities that may not match the physically-based salinity calculations done in DSM2.The apparent violations in the model results are referred to as "potential violations" because they occur in the model but would not occur in actual operations. The Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative.

Table 7-11. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Emmaton Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	2.0	0.0 (1.0%)	2.4	0.1 (2.8%)
November	1.5	0.0 (0.8%)	2.2	0.1 (3.7%)
December	1.0	0.0 (-1.5%)	1.5	0.0 (-0.7%)
January	0.5	0.0 (-2.6%)	0.7	0.0 (-3.4%)
February	0.3	0.0 (-1.9%)	0.4	0.0 (-3.1%)
March	0.2	0.0 (-0.8%)	0.3	0.0 (-1.5%)
April	0.3	0.0 (0.9%)	0.3	0.0 (2.3%)
May	0.3	0.0 (3.7%)	0.5	0.0 (6.8%)
June	0.6	0.0 (2.2%)	1.1	0.0 (3.5%)
July	0.7	0.0 (4.4%)	1.3	0.1 (6.5%)
August	1.4	0.0 (2.1%)	2.3	0.1 (2.4%)
September	1.6	0.0 (1.2%)	3.0	0.1 (1.8%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mmhos/cm = millimhos per centimeter

Table 7-12. Simulated Number of Months of Exceedence of the Salinity Standard for the San Sacramento River at Emmaton Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	1	1.0 (100.0%)	1	1.0 (100.0%)
May	1	2.0 (200.0%)	1	2.0 (200.0%)
June	28	-1.0 (-3.6%)	18	1.0 (5.6%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)
August	69	1.0 (1.4%)	26	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Overall, the compliance of standards for the Sacramento River at Emmaton would be similar to the baseline levels under the No-Action Alternative. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19d (No-Action): Delta Salinity on the Old River at Rock Slough
Under the No-Action Alternative, changes in chloride concentrations would not affect compliance with the standard as the Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Rock Slough is the location of the CCWD diversion for the Contra Costa Canal. The actual requirement location is at Contra Costa Canal Pumping Plant No. 1, but in DSM2, the location is measured in the Old River at Rock Slough. The requirements, as defined in D-1641, specify a minimum number of days during the calendar year that the maximum mean daily chloride concentration of 150 mg/L must be maintained. Objectives for the Contra Costa Canal Pumping Plant No. 1 are defined in Table 7-13.

Table 7-13. D-1641 Water Quality Objective for Contra Costa Canal Pumping Plant No. 1

Year Type	Number of Days Each Calendar Year Chlorides Less Than or Equal to 150 mg/L
Wet	240
Above Normal	190
Below Normal	175
Dry	165
Critical	155

Source: SWRCB 2000

Note:
Year-types defined by Sacramento Valley Index. Maximum mean daily 150 mg/L Cl- for at least the number of days shown.

Key:
Cl- = chlorides
D-1641 = Water Right Decision 1641
mg/L = milligram per liter

Table 7-14 shows simulated monthly average chloride concentrations and percent change for the Old River at Rock Slough. On an average annual basis, the No-Action Alternative would not increase chloride concentrations by more than 10 percent. Maximum changes in chloride concentrations under the No-Action Alternative are less than 6.6 percent for dry and critical years.

Table 7-15 shows the average number of days in a year simulated chloride values exceeded the standard of 150 mg/L for the Old River at Rock Slough. An increase in the number of potential daily violations of the chloride standard would occur under the No-Action Alternative as compared with the Existing Condition during the months of December through March, and July through September. As described for Impact WQ-19c (No-Action) for Table 7-12, the apparent violations shown in Table 7-15 are referred to as “potential violations” because they occur in the model but would not occur in actual operations. The Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. Overall, the No-Action Alternative would not alter the compliance level for Old River at Rock Slough. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-14. Simulated Monthly Average Chlorides and Percent Change for the Old River at Rock Slough Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	No-Action Alternative Change ((mg/L) (%))	Existing Condition (mg/L)	No-Action Alternative Change (mg/L (%))
October	0.7	0.0 (0.5%)	0.7	0.0 (0.6%)
November	0.7	0.0 (0.3%)	0.8	0.0 (1.7%)
December	0.6	0.0 (4.4%)	0.8	0.0 (4.2%)
January	0.7	0.0 (6.2%)	0.8	0.1 (6.6%)
February	0.5	0.0 (10.0%)	0.5	0.0 (2.3%)
March	0.4	0.0 (7.2%)	0.4	0.0 (2.8%)
April	0.4	0.0 (1.4%)	0.4	0.0 (-1.1%)
May	0.4	0.0 (-2.5%)	0.4	0.0 (-4.4%)
June	0.3	0.0 (-1.1%)	0.4	0.0 (-0.3%)
July	0.4	0.0 (2.9%)	0.5	0.0 (3.1%)
August	0.5	0.0 (3.5%)	0.8	0.0 (1.9%)
September	0.7	0.0 (4.7%)	0.9	0.0 (-0.8%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mg/L = milligrams per liter

Table 7-15. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Old River at Rock Slough Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of days)	(Number of days)	(Number of days)	(Number of days)
October	17	0 (0%)	7	0 (0%)
November	0	0 (0%)	7	0 (0%)
December	0	1.2 (8.5%)	7	0 (0%)
January	0	3.5 (27.6%)	7	0 (0%)
February	0	2.6 (55.4%)	2	0 (0%)
March	0	1.4 (45.2%)	1	0 (0%)
April	0	0 (0%)	0	0 (0%)
May	0	0 (0%)	0	0 (0%)
June	0	0 (0%)	0	0 (0%)
July	0	0 (0%)	3	0 (0%)
August	0	0 (0%)	10	0 (0%)
September	1	2.2 (12.4%)	11	0 (0%)
Total	0	12.6 (12.8%)	54	1.4 (2.5%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Impact WQ-19e (No-Action): Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. Both requirements would continue to be met under the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-16 shows both the chloride and EC thresholds that must be met at Jones Pumping Plant. Tables 7-17 and 7-18 show that the No-Action Alternative would not exceed chloride thresholds. Chloride concentrations decrease in the Delta-Mendota Canal at Jones Pumping Plant under the No-Action Alternative. Tables 7-19 and 7-20 show that EC would decrease under the No-Action Alternative and would not exceed the EC threshold. The No-Action Alternative would not change the baseline compliance levels under both Existing and Future conditions. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-16. D-1641 Water Quality Objective for the Delta-Mendota Canal at the Jones Pumping Plant

Year Type	Month	Chloride Concentration (mg/L)	Electrical conductivity (mmhos/cm)
All	October-September	250	1.0

Source: SWRCB 2000

Note:
Year types defined by Sacramento Valley Index.

Key:
D-1641 = Water Right Decision 16-41
mg/L = milligrams per liter
mmhos/cm = millimhos per centimeter

Table 7-17. Simulated Monthly Average Chlorides and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	No-Action Alternative Change ((mg/L) (%))	Existing Condition (mg/L)	No-Action Alternative Change (mg/L (%))
October	107.1	-1.9 (-1.8%)	117.9	-1.0 (-0.8%)
November	105.8	-2.7 (-2.6%)	118.9	-0.5 (-0.5%)
December	124.1	-6.0 (-4.8%)	142.3	-5.5 (-3.9%)
January	141.4	-11.9 (-8.4%)	165.9	-14.8 (-8.9%)
February	123.6	-9.9 (-8.0%)	159.4	-11.2 (-7.0%)
March	106.9	-9.8 (-9.2%)	157.9	-11.0 (-7.0%)
April	84.0	-15.4 (-18.4%)	123.4	-15.0 (-12.2%)
May	75.3	-9.3 (-12.3%)	106.4	-8.7 (-8.2%)
June	66.4	-5.6 (-8.4%)	81.4	-5.8 (-7.1%)
July	60.8	-2.0 (-3.3%)	83.1	-0.9 (-1.1%)
August	82.2	-1.5 (-1.9%)	121.9	-0.7 (-0.6%)
September	109.5	-2.0 (-1.8%)	145.0	-3.3 (-2.2%)

Source: , Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)
Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Key:
mg/L = milligrams per liter

Table 7-18. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of days)	(Number of days)	(Number of days)	(Number of days)
October	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)
May	0	0 (0%)	0	0 (0%)
June	0	0 (0%)	0	0 (0%)
July	0	0 (0%)	0	0 (0%)
August	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)
Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Table 7-19. Simulated Monthly Average Salinity and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	0.6	0.0 (-1.3%)	0.6	0.0 (-0.6%)
November	0.5	0.0 (-1.8%)	0.6	0.0 (-0.3%)
December	0.6	0.0 (-3.6%)	0.7	0.0 (-3.0%)
January	0.7	0.0 (-6.4%)	0.8	-0.1 (-7.0%)
February	0.6	0.0 (-5.9%)	0.7	0.0 (-5.5%)
March	0.6	0.0 (-6.5%)	0.7	0.0 (-5.4%)
April	0.5	-0.1 (-12.1%)	0.6	-0.1 (-9.0%)
May	0.4	0.0 (-7.8%)	0.6	0.0 (-5.8%)
June	0.4	0.0 (-5.1%)	0.5	0.0 (-4.6%)
July	0.4	0.0 (-1.9%)	0.5	0.0 (-0.7%)
August	0.5	0.0 (-1.2%)	0.6	0.0 (-0.4%)
September	0.6	0.0 (-1.3%)	0.7	0.0 (-1.7%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006) converted to chlorides using the equation EC*0.273-43.9)*

Note:

Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:

mmhos/cm = millimhos per centimeter

Table 7-20. Simulated Number of Months of Exceedence of the Salinity Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Impact WQ-19f (No-Action): Delta Water Quality on the West Canal at the Mouth of the Clifton Court Forebay The 250 mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under the No-Action Alternative. The No-Action Alternative would result in both increases and decreases in EC in comparison to baseline conditions; however, changes in EC would not affect compliance with the standard as the Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Clifton Court Forebay is the source of water supply for the Banks Pumping Plant and SWP exports south of the Delta. Similar to the Delta-Mendota Canal at Jones Pumping Plant, the water quality requirement on the West Canal at the mouth of the Clifton Court Forebay has two components, a chloride requirement and an EC requirement. Table 7-21 shows both the chloride and EC concentration requirements.

Table 7-21. D-1641 Water Quality Objective for the West Canal at the Mouth of the Clifton Court Forebay

Year Type	Month	Chloride Concentration (mg/L)	Electrical conductivity (mmhos/cm)
All	October–September	250	1.0

Source: SWRCB 2000

Note:
Year types defined by Sacramento Valley Index.

Key:
D-1641 = Water Right Decision 1641
mg/L = milligrams per liter
mmhos/cm = millimhos per centimeter

Table 7-22 shows that maximum chloride concentrations would be lower under the No-Action Alternative than the 250 mg/L threshold. Maximum increases under the No-Action Alternative would be less than 1.1 percent. As shown in Table 7-23, the maximum increase in EC values under the No-Action Alternative would be less than 1 percent, and would decrease in most months.

Table 7-22. Simulated Monthly Average Chlorides and Percent Change for West Canal at the Clifton Court Forebay Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	No-Action Alternative Change ((mg/L) (%))	Existing Condition (mg/L)	No-Action Alternative Change (mg/L (%))
October	110.8	-0.4 (-0.4%)	124.3	0.8 (0.6%)
November	107.2	-1.6 (-1.4%)	123.4	1.4 (1.1%)
December	109.2	-2.2 (-2.0%)	131.8	-0.7 (-0.6%)
January	128.1	-7.6 (-5.9%)	154.3	-9.0 (-5.8%)
February	107.5	-8.3 (-7.7%)	134.7	-10.5 (-7.8%)
March	91.9	-8.3 (-9.0%)	132.1	-9.7 (-7.3%)
April	75.6	-14.8 (-19.6%)	110.3	-14.0 (-12.7%)
May	70.8	-9.1 (-12.9%)	99.9	-8.3 (-8.3%)
June	56.4	-4.6 (-8.2%)	73.4	-4.8 (-6.6%)
July	52.2	-0.8 (-1.6%)	82.6	-0.3 (-0.4%)
August	80.5	-0.1 (-0.1%)	128.2	-0.7 (-0.6%)
September	115.0	-0.1 (-0.1%)	157.5	-2.8 (-1.8%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mg/L = milligrams per liter

Table 7-23. Simulated Monthly Average Salinity and Percent Change for West Canal at the Clifton Court Forebay Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	0.6	0.0 (-0.3%)	0.6	0.0 (0.5%)
November	0.6	0.0 (-1.0%)	0.6	0.0 (0.8%)
December	0.6	0.0 (-1.4%)	0.6	0.0 (-0.4%)
January	0.6	0.0 (-4.4%)	0.7	0.0 (-4.5%)
February	0.6	0.0 (-5.5%)	0.7	0.0 (-5.9%)
March	0.5	0.0 (-6.1%)	0.6	0.0 (-5.5%)
April	0.4	-0.1 (-12.4%)	0.6	-0.1 (-9.1%)
May	0.4	0.0 (-8.0%)	0.5	0.0 (-5.8%)
June	0.4	0.0 (-4.6%)	0.4	0.0 (-4.1%)
July	0.4	0.0 (-0.9%)	0.5	0.0 (-0.3%)
August	0.5	0.0 (0.0%)	0.6	0.0 (-0.4%)
September	0.6	0.0 (-0.1%)	0.7	0.0 (-1.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mmhos/cm = millimhos per centimeter

Table 7-24 shows the average number of days simulated chloride values exceeded the standards of 250 mg/L for the West Canal at the Clifton Court Forebay in a year. There would be no additional violations throughout the year for average annual or dry and critical years under the No-Action Alternative. The No-Action Alternative would not change the baseline compliance levels.

Table 7-24. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the West Canal at the Clifton Court Forebay Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	**No-Action Alternative**	**Existing Condition**	**No-Action Alternative**
	(Number of days)	**(Number of days)**	**(Number of days)**	**(Number of days)**
October	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)
May	0	0 (0%)	0	0 (0%)
June	0	0 (0%)	0	0 (0%)
July	0	0 (0%)	0	0 (0%)
August	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

As shown in Table 7-25, the No-Action Alternative would result in potential additional violations of the salinity standards in November and December, and would result in decreases in EC violations during January. As described under Impact WQ-19c (No-Action) for Table 7-12, the apparent violations shown in Table 7-25 are referred to as “potential violations” because they occur in the model but would not occur in actual operations. The Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. Overall, the No-Action Alternative would not alter the compliance level for the West Canal at the Clifton Court Forebay. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-25. Simulated Number of Months of Exceedence of the Salinity Standard for the West Canal at the Clifton Court Forebay Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	1.0 (0.0%)	0	0.0 (0.0%)
November	0	3.0 (0.0%)	0	2.0 (0.0%)
December	0	2.0 (0.0%)	0	1.0 (0.0%)
January	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19g (No-Action): Delta Salinity on the San Joaquin River at Vernalis Under the No-Action Alternative, on an average monthly basis, EC would meet requirements in all months, in both average years and in dry and critical years. The No-Action Alternative would exceed EC thresholds on the San Joaquin River at Vernalis in some months; however, changes in EC would not affect compliance with the standard as the Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

To protect water quality in the south Delta, D-1641 includes a salinity objective at several locations on the San Joaquin River and on the Old River. The objective is the same for all four locations: the San Joaquin River at Airport Way Bridge in Vernalis, the San Joaquin River at Brandt Bridge, the Old River near the Middle River, and the Old River at Tracy Road Bridge. The water quality requirement is a maximum 30-day average of mean daily EC. Table 7-26 shows the south Delta water quality requirement.

Table 7-26. D-1641 South Delta Water Quality Objective

Year Type	Months	EC Standard (mmhos/cm)
All	April–August	0.7
All	September–March	1.0

Source: SWRCB 2000

Note:
Year types defined by Sacramento Valley Index. Although requirement in D-1641 is the maximum 30-day running average of mean daily EC, modeling uses a monthly average. San Joaquin River at Vernalis measured at the Airport Way Bridge.

Key:
D-1641 = Water Right Decision 1641
EC = electrical conductivity
mmhos/cm = millimhos per centimeter

Under the No-Action Alternative, on an average monthly basis, EC would meet requirements in most months in both average years and in dry and critical years. As shown in Tables 7-27 and 7-28, the No-Action Alternative would exceed EC thresholds on the San Joaquin River at Vernalis more frequently in July and August; however, EC would decrease under the No-Action Alternative in May and June. As described under Impact WQ-19c (No-Action) for Table 7-12, the apparent violations shown in Table 7-25 are referred to as “potential violations” because they occur in the model but would not occur in actual operations. The Delta is operated to meet water quality standards and would continue being operated to meet standards under the No-Action Alternative. Overall, the No-Action Alternative would not change the baseline compliance levels. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-27. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Vernalis Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	**No-Action Alternative Change ((mmhos/cm) (%))**	**Existing Condition** (mmhos/cm)	**No-Action Alternative Change (mmhos/cm (%))**
October	0.5	0.0 (-6.2%)	0.5	0.0 (-6.4%)
November	0.6	0.0 (-6.6%)	0.6	0.0 (-6.8%)
December	0.8	-0.1 (-8.5%)	0.8	-0.1 (-9.2%)
January	0.8	-0.1 (-12.2%)	0.9	-0.1 (-14.1%)
February	0.7	0.0 (-6.8%)	0.9	0.0 (-5.1%)
March	0.6	0.0 (-7.8%)	0.9	-0.1 (-6.6%)
April	0.4	-0.1 (-13.1%)	0.6	-0.1 (-9.6%)
May	0.4	0.0 (-8.4%)	0.5	0.0 (-6.7%)
June	0.5	0.0 (-5.5%)	0.6	0.0 (-4.1%)
July	0.6	0.0 (-4.0%)	0.7	0.0 (-1.1%)
August	0.6	0.0 (-6.4%)	0.6	0.0 (-3.2%)
September	0.6	0.0 (-6.6%)	0.6	0.0 (-5.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mmhos/cm = millimhos per centimeter

Table 7-28. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Vernalis Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)
May	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
June	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)
August	3	-2.0 (-66.7%)	3	-2.0 (-66.7%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19h (No-Action): Delta Salinity on the San Joaquin River at Brandt Bridge On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years under the No-Action Alternative. The No-Action Alternative would not change EC on the San Joaquin River at Brandt Bridge. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the San Joaquin River at Brandt Bridge. Table 7-26 details water quality requirement standards for salinity.

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-29. Table 7-30 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Brandt Bridge in the period of simulation. The No-Action Alternative would decrease occurrence of EC values exceeding the standards in April, May, June, and August. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-29. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Brandt Bridge Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	0.5	0.0 (-6.2%)	0.5	0.0 (-6.3%)
November	0.6	0.0 (-6.5%)	0.6	0.0 (-6.8%)
December	0.8	-0.1 (-8.2%)	0.8	-0.1 (-8.9%)
January	0.8	-0.1 (-11.7%)	0.9	-0.1 (-13.6%)
February	0.7	0.0 (-7.0%)	0.9	-0.1 (-5.7%)
March	0.6	0.0 (-7.6%)	0.9	-0.1 (-6.3%)
April	0.4	-0.1 (-12.7%)	0.6	-0.1 (-9.2%)
May	0.4	0.0 (-8.2%)	0.6	0.0 (-6.3%)
June	0.5	0.0 (-5.3%)	0.6	0.0 (-3.9%)
July	0.6	0.0 (-4.0%)	0.7	0.0 (-1.3%)
August	0.6	0.0 (-5.8%)	0.6	0.0 (-2.7%)
September	0.6	0.0 (-6.4%)	0.6	0.0 (-4.8%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN072)
Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.
Key:
mmhos/cm = millimhos per centimeter

Table 7-30. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Brandt Bridge Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
June	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN072)
Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19i (No-Action): Delta Salinity on the Old River near the Middle River Under the No-Action Alternative, on an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. The No-Action Alternative would decrease EC on the Old River near the Middle River. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the Old River near the Middle River. Table 7-26 details water quality requirement standards for salinity.

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-31. Table 7-32 shows the number of months simulated EC values exceeded the standards for the Old River near the Middle River in the period of simulation. The No-Action Alternative would decrease occurrence of EC values exceeding the standards in April, May, June, and August. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-31. Simulated Monthly Average Salinity and Percent Change for the Old River near the Middle River Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	0.4	0.0 (-2.0%)	0.5	0.0 (-1.8%)
November	0.5	0.0 (-2.9%)	0.5	0.0 (-2.2%)
December	0.5	0.0 (-1.4%)	0.5	0.0 (-0.6%)
January	0.6	0.0 (-2.3%)	0.6	0.0 (-2.3%)
February	0.6	0.0 (-4.7%)	0.6	0.0 (-5.6%)
March	0.5	0.0 (-6.0%)	0.6	0.0 (-5.8%)
April	0.5	0.0 (-9.7%)	0.6	0.0 (-6.3%)
May	0.4	0.0 (-8.3%)	0.5	0.0 (-5.9%)
June	0.4	0.0 (-5.1%)	0.4	0.0 (-4.6%)
July	0.3	0.0 (-1.6%)	0.4	0.0 (-0.8%)
August	0.4	0.0 (-0.8%)	0.5	0.0 (-0.2%)
September	0.4	0.0 (-1.3%)	0.5	0.0 (-1.5%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID040)

Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.

Key:
mmhos/cm = millimhos per centimeter

Table 7-32. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River near the Middle River Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition	No-Action Alternative	Existing Condition	No-Action Alternative
	(Number of months)	(Number of months)	(Number of months)	(Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
June	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID040)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Impact WQ-19j (No-Action): Delta Salinity on the Old River at Tracy Road Bridge Under the No-Action Alternative on an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, and would decrease EC on the Old River at Tracy Road Bridge in some months. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the Old River at Tracy Road Bridge. Table 7-26 details water quality requirement standards for salinity.

The No-Action Alternative would decrease EC on the Old River at Tracy Road Bridge in some months, as shown in Table 7-33. Table 7-34 shows the number of months simulated EC values exceeded the standards for the Old River near Tracy Road Bridge in the period of simulation. The No-Action Alternative would decrease occurrence of EC values exceeding the standards in April, May, and August. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Table 7-33. Simulated Monthly Average Salinity and Percent Change for the Old River at Tracy Road Bridge Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	No-Action Alternative Change ((mmhos/cm) (%))	Existing Condition (mmhos/cm)	No-Action Alternative Change (mmhos/cm (%))
October	0.5	0.0 (-5.5%)	0.6	0.0 (-5.7%)
November	0.6	0.0 (-6.1%)	0.6	0.0 (-6.5%)
December	0.8	-0.1 (-7.9%)	0.8	-0.1 (-8.7%)
January	0.8	-0.1 (-10.3%)	0.9	-0.1 (-12.4%)
February	0.7	0.0 (-6.5%)	0.9	-0.1 (-5.6%)
March	0.6	0.0 (-7.1%)	0.9	-0.1 (-5.9%)
April	0.5	-0.1 (-12.2%)	0.6	-0.1 (-8.8%)
May	0.4	0.0 (-8.0%)	0.6	0.0 (-6.1%)
June	0.5	0.0 (-5.0%)	0.6	0.0 (-3.6%)
July	0.6	0.0 (-3.9%)	0.7	0.0 (-1.8%)
August	0.6	0.0 (-4.6%)	0.6	0.0 (-1.1%)
September	0.6	0.0 (-5.1%)	0.6	0.0 (-2.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)
Note:
Simulation period: 1922–2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.
Key:
mmhos/cm = millimhos per centimeter

Table 7-34. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Tracy Road Bridge Under the Existing Condition and No-Action Alternative

	Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	No-Action Alternative (Number of months)	Existing Condition (Number of months)	No-Action Alternative (Number of months)
October	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)
January	1	-1.0 (-100.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)
April	7	-2.0 (-28.6%)	7	-2.0 (-28.6%)
May	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)
August	4	-1.0 (-25.0%)	4	-1.0 (-25.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Impact WQ-20 (No-Action): X2 Position The No-Action Alternative would change average monthly X2 in some months by more than 0.1 kilometer (km). This impact would be potentially significant.

Table 7-35 shows the simulated monthly average X2 position for the No-Action Alternative compared to the Existing Condition. As previously described, the X2 parameter is measured in distance upstream from the Golden Gate Bridge in Suisun Bay, and is required to be maintained at not more than 75 km during the months of February through June. CalSim-II calculates the X2 position on a 1-month delay; the values shown have been corrected to accurately reflect the X2 position for the specified month. As shown in Table 7-35, the No-Action Alternative would shift X2 upstream by up to 0.2 km in May and June on an average annual basis, and by as much as 0.4 km in May of dry and critical years. This impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Table 7-35. Simulated Monthly Average X2 Position Under the Existing Condition and No-Action Alternative

Month	Average All Years		Dry and Critical Years	
	Existing Condition (km)	No-Action Alternative Change ((km) (%))	Existing Condition (km)	No-Action Alternative Change (km (%))
October	83.9	0.0 (0.0%)	86.6	0.0 (0.0%)
November	82.2	0.0 (0.0%)	86.5	0.1 (0.1%)
December	76.1	-0.1 (-0.1%)	84.8	-0.1 (-0.2%)
January	67.5	-0.2 (-0.3%)	79.6	-0.3 (-0.4%)
February	60.9	-0.1 (-0.2%)	72.5	-0.2 (-0.3%)
March	60.9	0.0 (0.0%)	70.3	0.0 (0.0%)
April	63.5	-0.1 (-0.2%)	72.9	0.0 (0.0%)
May	67.5	0.2 (0.2%)	77.6	0.4 (0.5%)
June	74.5	0.2 (0.2%)	82.6	0.2 (0.3%)
July	80.5	0.0 (0.1%)	86.1	0.0 (0.0%)
August	85.6	0.0 (0.0%)	88.8	-0.2 (-0.3%)
September	82.6	0.0 (0.0%)	91.1	-0.2 (-0.2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node X2_PRV)
Note:
Simulation period: 1922-2003. Change as measured from Existing Condition. Dry and critical years as defined by the Sacramento Valley Index.
Key:
km = kilometer
X2 = geographic location of 2 parts per thousand near-bottom salinity isohaline in the Delta, measured in distance upstream from Golden Gate Bridge in Suisun Bay.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 focuses on increasing water supply reliability and increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 6.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 8.5 feet and enlarge the total storage capacity in the reservoir by 256,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 70 thousand acre-feet (TAF) and 35 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP1 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Shasta Lake and Vicinity

Impact WQ-1 (CP1): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality

Standards or Adversely Affect Beneficial Uses The construction-related activities described in Chapter 2, “Alternatives,” would result in short-term changes in the amount of exposed area that would be subject to erosion. In addition to the clearing of vegetation in various areas to accommodate relocation activities, about 500 acres of vegetation in parts of the new inundation area would be cleared. Removal of vegetation would reduce the amount of effective ground cover (e.g., duff, large woody debris), thereby increasing the potential for short-term erosion and sedimentation along the shoreline. This impact would be potentially significant.

The relocation activities would result in exposing as many as 3,337 acres to some amount of soil disturbance. These effects are described in more detail in Chapter 4, “Geology, Geomorphology, Minerals, and Soils.” The disturbed sites would have the potential to contribute sediments to nearby water bodies.

Although the environmental protection measures and BMPs described in Chapter 2, “Alternatives.” are intended to reduce the potential effects of introducing sediment into Shasta Lake and its tributaries, CP1 would affect water quality by increasing the levels of turbidity and suspended sediment in the receiving waters at levels that could be inconsistent with the Basin Plan. These increased levels of turbidity and suspended sediment could affect the beneficial uses of Shasta Lake and/or its tributaries. Therefore, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-2 (CP1): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Because of the large water surface area of Shasta Lake, coupled with the isolated and discrete nature of the relocation activities on the tributaries, temporary construction-related effects are not expected to modify water temperature in a manner that would have a negative effect on beneficial uses or result in a water quality violation. Therefore, this impact would be less than significant.

Under CP1, construction activities associated with enlarging Shasta Dam as well as the relocation actions would result in sizeable areas that would be subject to surface disturbance, including jurisdictional waters within the influence zone of this alternative. Efforts to document jurisdictional waters associated with relocation areas are ongoing. This information will be included if available in the Final EIS, as well as in the Section 404 permitting package, before issuance of a ROD.

Environmental commitments and BMPs for the various construction and relocation activities (e.g., bridge replacement, boat ramp construction, demolition of facilities) have been incorporated into CP1. These activities could include removal of riparian vegetation, thereby exposing water bodies to increased solar radiation for various time periods. As described in Chapter 2, “Alternatives,” a riparian revegetation program would be implemented at all construction and relocation sites as applicable to ensure that shade is quickly reestablished after construction is completed.

As described in Chapter 2, "Alternatives," although the TCD may not be operational for some period of time during construction, project sequencing would ensure that changes to water temperature and associated limnological conditions would be consistent with those that occur periodically under the No-Action Alternative associated with maintenance and outage periods.

Because of the large water surface area of Shasta Lake, coupled with the isolated and discrete nature of the relocation activities on the tributaries, temporary construction-related effects are not expected to modify water temperature in a manner that would have a negative effect on beneficial uses or result in a water quality violation. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-3 (CP1): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Under CP1, no construction activities would occur that would disturb locations known to contain elevated metal concentrations in either sediments or the water column. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-4 (CP1): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Under CP1, the exposure of an additional 1,227 acres of shoreline surrounding Shasta Lake would result in a potential for increased wave-related shoreline erosion (see Chapter 4, "Geology, Geomorphology, Minerals, and Soils"). As the reservoir is lowered during summer and fall, the exposed surface area would also be subject to surficial erosion processes that could mobilize and transport sediment to the newly expanded Shasta Lake. Although environmental commitments and BMPs are incorporated into the project description, the project would result in an incremental increase in the delivery of suspended sediment and turbidity to the receiving waters. The amount of sediment that could be delivered is not quantifiable because of the size of the lake and the number of variables that influence sediment transport and delivery. This impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-5 (CP1): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries CP1 would store some additional flows behind Shasta Dam during periods when the flows would have otherwise been released downstream. The resulting increase in storage would then be used both to create an expanded CWP available for carryover storage, thus benefiting fisheries, and for subsequent release to support beneficial uses downstream. On average, CP1 would provide approximately a 5 percent increase in annual storage.

Table 7-36 shows the simulated monthly change in storage for CP1 as a percent increase above the No-Action Alternative.

Table 7-36. Simulated Average Increased End-of-Month Shasta Lake Storage – CP1

Month	Existing Conditions (TAF)	CP1 (TAF)	CP1 % Increase
October	2,592	148	5.7%
November	2,568	142	5.5%
December	2,722	161	5.9%
January	2,995	167	5.6%
February	3,267	178	5.5%
March	3,625	182	5.0%
April	3,916	177	4.5%
May	3,941	179	4.5%
June	3,639	178	4.9%
July	3,160	170	5.4%
August	2,834	166	5.9%
September	2,669	157	5.9%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)
Note:
Simulation period: 1922-2003
Key:
TAF = thousand acre-feet

Under CP1, existing water temperature requirements would typically be met in most years; therefore, the additional increase in water storage shown in Table 7-36 would primarily be released for water supply purposes. Accordingly, minimal increases in releases from Shasta Dam would be expected in months when Delta exports are constrained, or when flow is not usable for water supply purposes.

As shown in Table 7-36, the increase in storage provided by CP1 fluctuates greatly throughout a year; storage is typically highest at the end of winter, in April and May, as the need for flood control reservation space in the reservoir is reduced. Storage is typically at its lowest in September, October, and November, after summer irrigation concludes and before winter refill begins. Additional runoff captured by the increased storage increment would typically remain in storage and available to support beneficial uses downstream. Conversely, if insufficient water in storage existed to meet downstream demands, the first increment to be reduced would be deliveries to water service contractors. As such, increased releases would typically be made on a schedule providing increased reliability of deliveries to water service contractors, typically in July through October of relatively dry years.

A key indicator of the water temperature benefits of CP1 to the upper Sacramento River between Keswick Dam and Red Bluff is the amount of cold water available in Shasta Lake before the water temperature operation season, about May through October. As previously described, Shasta Lake generally reaches its maximum storage during late April or early May. Also, the CWP volume in the lake accumulates during winter and early spring and is not likely to increase after April. Therefore, the expected increase in spring storage for CP1 should also result in an incremental increase in the CWP volume.

The simulated end-of-April volume of water with a temperature lower than 52°F for the No-Action Alternative and the change in CWP volume for CP1 is shown, by Sacramento Valley Index (SVI) year type, in Table 7-37.

In addition to illustrating the average change in available CWP, Table 7-37 also shows the influence of climatic conditions on these values. The diversity between water year types, coupled with unique combinations of storage and rainfall, would continue to influence the ability to manage storage in Shasta Lake to maximize carryover capacity. Although an increase in the active storage and carryover storage of the CWP would occur, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-37. Simulated Average Volume of Water Less than 52°F in Shasta Lake at the End of April – CP1

SVI Year Type	Existing Conditions (TAF)	CP1 (TAF)	% Increase
Average of All Years	2,609	142	5%
Wet	2,804	186	7%
Above Normal	2,972	163	5%
Below Normal	2,699	129	5%
Dry	2,542	130	5%
Critical	1,601	49	3%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations.
Notes:
Simulation period: 1922–2003
Year types as defined by the Sacramento Valley Index
Key:
SVI = Sacramento Valley Index
TAF = thousand acre-feet

Impact WQ-6 (CP1): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries The increase in storage associated with CP1 would result in modifying the depth and thickness of the thermocline in Shasta Lake. The level of change would be correlated to a number of parameters, including carryover storage, climatic conditions, and the timing and duration of stratification (Bartholow et al. 2001). A study conducted by the CVRWQCB in 2002 and 2003 suggests that a direct correlation exists between dissolved copper concentrations in the upper levels of Shasta Lake near the dam and dissolved copper concentrations in the waters immediately downstream from the power plant (CVRWQCB 2003a). This study concluded that there appears to be a correlation between operation of the TCD and concentration of dissolved metals within the thermocline; an increase in available storage, however, would increase the opportunity to dilute metals concentrations below current levels.

Within the Squaw Creek Arm, two depositional features associated with historic copper mining and smelting operations are immediately adjacent to the shoreline of Shasta Lake in the general vicinity of the Bully Hill Mine. As mapped, these two sites appear to have about 7,300 cubic yards of material that could be subjected to shoreline and surficial erosional processes, with a high potential for delivery to Shasta Lake. This impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (CP1): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction would include ground-disturbing activities that could result in soil erosion and sediment effects on the upper Sacramento River. This impact would be potentially significant.

As described in Impact WQ-1 (CP1), ground-disturbing activities associated with construction could cause soil erosion and sedimentation of local drainages and eventually the Sacramento River. Construction activities could also discharge waste petroleum products or other construction-related substances that could enter these waterways/facilities in runoff. The environmental protection measures and BMPs described in Chapter 2, “Alternatives,” are intended to reduce the potential effects of introducing sediment into Shasta Lake and into downstream releases to the upper Sacramento River; however, CP1 would affect water quality by increasing the levels of turbidity and suspended sediment in the receiving waters at levels that could be inconsistent with the Basin Plan. These increased levels of turbidity and suspended sediment could affect the beneficial uses of the upper Sacramento River. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-8 (CP1): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality

Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in temperature effects on the upper Sacramento River because changes to water temperature in Shasta Lake and subsequent releases to the Sacramento River would be consistent with typical periodic fluctuations. This impact would be less than significant.

As described for Impact WQ-2 (CP1), changes to water temperature and associated limnological conditions in Shasta Lake would be consistent with those that occur periodically under the No-Action Alternative associated with maintenance and outage periods. Therefore, water temperatures in the upper Sacramento River, which are related to releases from Shasta Lake, would not be expected to be modified during construction in a manner that would negatively affect beneficial uses or result in a water quality violation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-9 (CP1): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in water quality effects on the upper Sacramento River related to metals because construction would not disturb locations of known elevated metal concentrations. This impact would be less than significant.

As described in Impact WQ-3 (CP1), there would be no construction activities that would disturb locations known to contain elevated metal concentrations in either sediments or the water column of Shasta Lake. Because water quality in the upper Sacramento River is related to the quality of releases from Shasta Lake, metals concentrations would not be expected to be modified during construction in a manner that would negatively affect beneficial uses or result in a water quality violation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-10 (CP1): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River No long-term water quality impacts are anticipated in the upper Sacramento River in regard to sediment, because modeling results have indicated that CP1 would cause little change in average mean monthly flow, and could cause a decrease in peak flows that are associated with increased sediment transport. This impact would be less than significant.

Long-term effects on water quality could be caused by changes in the size and timing of releases from the reservoir associated with CP1. The analysis used flow data from hydrologic modeling as an indicator of effects on sediment and metals.

For CP1, fall and winter flows on the upper Sacramento River would be reduced in some years, and summer flows would increase in many years. In addition, retention of winter flows would reduce or eliminate some overbank flood events in the upper Sacramento River. Because the reservoir would be able to store additional water during high-flow periods, in some years wintertime peak flows would be reduced as a result of the project. High-flow events transport sediments and can produce bank erosion and meander.

The Basin Plan specifies that changes to suspended sediment loading and discharge rates cannot cause nuisance or adversely affect beneficial uses (CVRWQCB 2007b). Under both existing and future conditions, analysis of modeling results indicates that the generally small changes in average mean monthly flow from CP1 are unlikely to have a significant effect on sediment transport within the upper Sacramento River. In addition, it appears that CP1 would reduce wintertime peak flow events, which may reduce sediment loading and discharge rates. Beneficial uses that may be beneficially affected include municipal and domestic supply, irrigation and stock watering, service supply, power, contact recreation and canoeing and rafting, other noncontact recreation, and navigation. However, there could be varying effects on beneficial uses concerning habitat, such as freshwater and spawning habitat. These impacts are explored further in Chapter 11, “Fisheries and Aquatic Resources.” Because the project would cause little change in average mean monthly flow, and a potential decrease in peak flows, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-11 (CP1): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Analysis of temperature modeling results indicates that CP1 would improve compliance with the temperature requirements on the Sacramento River because of the increased depth of the cold-water pool in Shasta Lake and the associated enhanced ability to regulate water temperature releases to the upper Sacramento River. Therefore, the impact of CP1 on water quality measured as temperature would be beneficial.

CP1 would increase the ability of Shasta Dam to release cold water and regulate water temperature in the upper Sacramento River, primarily in dry and critical years. This would be accomplished by raising Shasta Dam 6.5 feet, thus increasing the depth of the cold-water pool in Shasta Lake and resulting in an increase in seasonal cold-water volume below the thermocline (i.e., layer of greatest water temperature and density change). Cold water released from Shasta Dam influences water temperature conditions in the Sacramento River between Keswick Dam and RBPP, with effects diminishing downstream.

This section focuses on compliance with water quality standards for temperature. For an analysis of temperature effects on fisheries and aquatic habitat, see Chapter 11, “Fisheries and Aquatic Resources.”

Analysis of temperature modeling results indicates that CP1 would improve compliance with the temperature requirements on the Sacramento River. The 2009 BO for CVP and SWP operations and their effects on the Sacramento River winter-run Chinook salmon require that Sacramento River water temperatures be below 56°F at compliance locations between Balls Ferry and Bend Bridge from April 15 through September 30, and not in excess of 60°F at the same compliance locations in during October. Currently, this standard is not always met, particularly in dry and critical years. CP1 would reduce the amount of daily exceedences of the 2009 BO standards under both existing and future conditions. Table 7-38 provides a summary of modeled reductions in exceedences over the 82-year modeling period under each of the alternatives.

Based on this analysis, the impact of CP1 on water quality measured as temperature would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Table 7-38. Modeled Reduction in Daily Exceedences of Sacramento River Temperature Requirements (as Defined by the 2004 Biological Opinion for CVP and SWP Operations and Their Effects on the Sacramento River Winter-Run Chinook Salmon) for April 1 – October 31

Comprehensive Plan	Existing Conditions (2005)		Future Conditions (2030)	
	Balls Ferry	Bend Bridge	Balls Ferry	Bend Bridge
CP1	7%	5%	11%	4%
CP2	12%	7%	14%	7%
CP3	16%	10%	19%	11%
CP4	29%	12%	31%	12%
CP5	15%	10%	16%	10%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations

Note:
Simulation period: 1922–2003
Source: Data provided by MWH in 2007

Key:
CVP = Central Valley Project
SWP = State Water Project

Impact WQ-12 (CP1): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Long-term operation of the project could result in water quality effects on the upper Sacramento River in regard to metals as a result of erosional processes to historic mining and smelting operation features. This impact would be potentially significant.

The analysis used flow data from hydrologic modeling as an indicator of effects on sediment and metals. The Sacramento River and its tributaries upstream from Keswick Dam are the primary source of metals to the lower Sacramento River (USGS 2000b). Shasta Lake is also listed as impaired for metals. As described in Impact WQ-6 (CP1), a study conducted by the CVRWQCB in 2002 and 2003 suggests that a direct correlation exists between dissolved copper concentrations in the upper levels of Shasta Lake near the dam and dissolved copper concentrations in the waters immediately downstream from the power plant (CVRWQCB 2003a).

The 25-mile reach of the Sacramento River from Keswick Dam downstream to Cottonwood Creek is impaired for cadmium, copper, and zinc. The CVRWQCB developed a TMDL program for these constituents in the upper Sacramento River because of exceedences of water quality standards. Heavy metals such as copper, zinc, mercury, lead, and cadmium are water quality parameters that are impairing beneficial uses. Natural mineral deposits and historical mining practices are a source of metals, including mercury, within Shasta Lake and the upper Sacramento River. High metals concentrations in the Sacramento River correlate with concentrations of suspended sediment and high flows because metals are transported adsorbed to suspended sediments (USGS 2000b; Domagalski et al. 2000).

Under both existing and future conditions, the generally small changes in average mean monthly flow from the project predicted by modeling are unlikely to have a significant effect on metals within the upper Sacramento River and would not be expected to result in exceedences of the dissolved metals numeric targets established in the TMDL (as shown in Table 7-3). Remediation activities at Iron Mountain Mine and other mine sites over the last several years, as well as dredging of contaminated sediment in the Spring Creek Arm of Keswick Reservoir in 2009 to 2010, are also expected to reduce the likelihood of future exceedences of the TMDL numeric targets below Keswick Dam.

However, as described in Impact WQ-6 (CP1), two depositional features associated with historic copper mining and smelting operation within the Squaw Creek Arm of Shasta Lake could be subjected to shoreline and surficial erosional processes, with a high potential for delivery to Shasta Lake and subsequent delivery to the upper Sacramento River. Therefore, the water quality impact of CP1 related to metals in the upper Sacramento River would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact WQ-13 (CP1): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction is not anticipated to affect water quality conditions in the extended study area. This impact would be less than significant.

Construction would only temporarily influence water quality in the primary study area. Construction effects are anticipated to be localized and would be further minimized with appropriate BMPs. Therefore, construction is not anticipated to affect water quality conditions downstream in the extended study area. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-14 (CP1): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses As described in Impact WQ-13 (CP1), construction is not anticipated to affect water temperature in the extended study area. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-15 (CP1): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses As described in Impact WQ-13 (CP1), construction is not anticipated to affect metals in the extended study area. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-16 (CP1): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Water quality effects of CP1 could influence the extended study area, but effects would diminish with distance into the study area. Water quality effects are attenuated by multiple factors including flow from tributaries, stormwater runoff, and municipal and agricultural discharges, as described below.

Because the Sacramento River is the primary supplier of suspended sediment to the Delta, sediment loading and discharge rates from the upper Sacramento River could affect water quality and beneficial uses in the extended study area. However, changes in sediment loading in the upper Sacramento River would be less than significant and changes in the extended study area would be even smaller. Therefore, the impact on sediment would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-17 (CP1): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Analysis of temperature modeling shows little to no change in temperature at RBPP caused by CP1. This suggests that there would be no changes in temperature beyond RBPP as a result of CP1. This conclusion is further supported by the operational experience of the CVP, which indicates that the 60-mile stretch of river between Keswick Dam and Red Bluff is the extent to which the Shasta-Trinity Division can control temperatures through normal operations of the CVP. Therefore, no temperature effects are anticipated in the extended study area. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-18 (CP1): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended

Study Area CP1 would alter the operations of Shasta Lake. Increases in metals concentrations can result from changes in flows that cause increases in concentrations of suspended sediments during high-flow periods. The reduction in frequency and magnitude of peak flow events resulting from CP1 would suggest a beneficial impact for metals; however, as described in Impact WQ-6 (CP1), two depositional features associated with historic copper mining and smelting operation within the Squaw Creek Arm of Shasta Lake could be subjected to shoreline and surficial erosional processes, with the potential for delivery to Shasta Lake and subsequent delivery to the Sacramento River. Therefore, the effects of CP1 related to metals in the lower Sacramento River could be potentially significant because operation of the project could add substantial additional amounts of metal to the river system. Thus, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Salinity CP1 would differ from the No-Action Alternative primarily through a 256-TAF enlargement of Shasta Lake. Potential impacts, which are evaluated below, include changes in the following:

- Delta salinity on the Sacramento River at Collinsville
- Delta salinity on the San Joaquin River at Jersey Point
- Delta salinity on the Sacramento River at Emmaton
- Delta salinity on the Old River at Rock Slough
- Delta water quality on the Delta-Mendota Canal at Jones Pumping Plant
- Delta water quality on the West Canal at the mouth of the Clifton Court Forebay
- Delta salinity on the San Joaquin River at Vernalis
- Delta salinity on the San Joaquin River at Brandt Bridge
- Delta salinity on the Old River near the Middle River
- Delta salinity on the Old River at Tracy Road Bridge
- X2 position

Impact WQ-19a (CP1): Delta Salinity on the Sacramento River at Collinsville Operations for CP1 would result in both increases and decreases in salinity in comparison with baseline conditions; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

The water quality requirement on the Sacramento River at Collinsville is specified in D-1641, and is defined for all year types, from October through April. The D-1641 objectives for the Sacramento River at Collinsville are defined in Table 7-4.

As shown in Table 7-39, operations for CP1 would result in both increases and decreases in salinity; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 5 percent. Table 7-40 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Collinsville in the period of simulation. The operation of CP1 would not result in any violations of the salinity standards for the Sacramento River at Collinsville under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-39. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Collinsville Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	6.0	0.0 (-0.5%)	7.1	0.0 (-0.1%)	6.0	0.0 (-0.6%)	7.1	0.0 (-0.4%)
November	5.1	0.0 (0.4%)	6.8	0.0 (-0.1%)	5.1	0.0 (0.2%)	6.9	0.0 (-0.4%)
December	3.6	0.0 (0.4%)	5.5	0.0 (0.6%)	3.6	0.0 (-0.1%)	5.5	0.0 (-0.2%)
January	1.8	0.0 (-0.3%)	3.4	0.0 (0.0%)	1.7	0.0 (0.8%)	3.3	0.0 (1.5%)
February	0.8	0.0 (0.6%)	1.7	0.0 (1.2%)	0.8	0.0 (1.2%)	1.6	0.0 (1.8%)
March	0.6	0.0 (0.4%)	1.2	0.0 (0.4%)	0.6	0.0 (0.6%)	1.1	0.0 (0.8%)
April	0.7	0.0 (0.0%)	1.4	0.0 (0.0%)	0.7	0.0 (-0.3%)	1.5	0.0 (-0.5%)
May	1.1	0.0 (0.1%)	2.3	0.0 (0.1%)	1.1	0.0 (-0.6%)	2.4	0.0 (-0.7%)
June	2.2	0.0 (0.2%)	4.0	0.0 (0.2%)	2.2	0.0 (0.1%)	4.1	0.0 (-0.2%)
July	3.2	0.0 (0.1%)	5.3	0.0 (0.0%)	3.2	0.0 (0.1%)	5.5	0.0 (0.0%)
August	5.3	0.0 (-0.2%)	7.3	0.0 (-0.4%)	5.4	0.0 (-0.2%)	7.4	0.0 (-0.4%)
September	5.2	0.0 (-0.5%)	8.8	-0.1 (-0.7%)	5.2	0.0 (-0.6%)	8.8	-0.1 (-1.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-40. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Collinsville Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19b (CP1): Delta Salinity on the San Joaquin River at Jersey Point
Operations for CP1 would result in both increases and decreases in salinity in comparison with baseline conditions; however, none of the increases would be sufficient to change compliance for the San Joaquin River at Jersey Point. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

The water quality requirement on the San Joaquin River at Jersey Point is specified in D-1641 as two components. The first component of the requirement begins on April 1, and extends through a year-type–dependent date. The second component of the Jersey Point requirement begins at the end of the first component, and ends on August 15. The numerical requirement of the second component is dependent on the year type. Objectives for the San Joaquin River at Jersey Point are defined in Table 7-7.

Table 7-41 shows simulated monthly average salinity and percent change for the San Joaquin River at Jersey Point. On an average monthly basis EC requirements would be satisfied in all months in an average year under CP1 operations. Furthermore, all changes during April through August would be less than 2 percent. Table 7-42 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Jersey Point in the period of simulation. CP1 would result in an increase in the frequency of violations under Existing Conditions. Violations occur during June and are 10 percent for all years and 12.5 percent during dry and critical years. The long-term and dry- and critical-year average EC values in June are found to be below the standards, which indicate the violation is marginal and does not show any significant changes in water quality in June. Overall, the frequency of exceedence of salinity standards for the San Joaquin River at Jersey Point under CP1 would be similar to those under Existing and Future conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-41. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Jersey Point Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	1.6	0.0 (-0.1%)	1.8	0.0 (0.1%)	1.6	0.0 (0.0%)	1.9	0.0 (-0.2%)
November	1.5	0.0 (1.7%)	1.8	0.0 (0.9%)	1.5	0.0 (1.3%)	1.8	0.0 (0.9%)
December	1.2	0.0 (1.2%)	1.8	0.0 (1.1%)	1.2	0.0 (0.5%)	1.7	0.0 (0.1%)
January	0.7	0.0 (0.8%)	1.1	0.0 (1.8%)	0.7	0.0 (1.3%)	1.0	0.0 (2.6%)
February	0.3	0.0 (1.2%)	0.5	0.0 (2.4%)	0.3	0.0 (2.3%)	0.5	0.0 (4.5%)
March	0.3	0.0 (0.2%)	0.3	0.0 (0.7%)	0.3	0.0 (0.8%)	0.3	0.0 (1.7%)
April	0.3	0.0 (0.0%)	0.3	0.0 (0.2%)	0.3	0.0 (0.1%)	0.3	0.0 (0.3%)
May	0.3	0.0 (0.1%)	0.4	0.0 (0.2%)	0.3	0.0 (0.0%)	0.4	0.0 (-0.1%)
June	0.4	0.0 (0.1%)	0.7	0.0 (0.2%)	0.4	0.0 (0.1%)	0.7	0.0 (-0.1%)
July	1.0	0.0 (0.3%)	1.7	0.0 (0.5%)	1.0	0.0 (0.6%)	1.7	0.0 (0.9%)
August	1.6	0.0 (0.0%)	2.2	0.0 (0.0%)	1.6	0.0 (0.1%)	2.1	0.0 (0.5%)
September	1.9	0.0 (0.4%)	2.8	0.0 (0.6%)	1.9	0.0 (0.5%)	2.8	0.0 (0.9%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-42. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Jersey Point Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	10	1.0 (10.0%)	8	1.0 (12.5%)	13	0.0 (0.0%)	11	0.0 (0.0%)
July	51	0.0 (0.0%)	22	0.0 (0.0%)	50	1.0 (2.0%)	21	1.0 (4.8%)
August	73	0.0 (0.0%)	25	0.0 (0.0%)	76	0.0 (0.0%)	27	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19c (CP1): Delta Salinity on the Sacramento River at Emmaton

Operations for CP1 would result in both increases and decreases in salinity in comparison to baseline conditions; however, none of the increases would be sufficient to change compliance for the Sacramento River at Emmaton. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

Similar to the water quality requirement on the San Joaquin River at Jersey Point, the water quality requirement on the Sacramento River at Emmaton is specified in D-1641 as two components. The first component of the requirement begins on April 1, and extends through a year-type-dependent date. The second component of the Emmaton requirement begins at the end of the first component, and ends on August 15. The numerical requirement of the second component is dependent on the year type. Objectives for the Sacramento River at Emmaton are defined in Table 7-10.

Although Table 7-43 shows the EC for all months, the Emmaton water quality requirement is only defined for April 1 through August 15. On an average monthly basis, no change in the ability to meet EC requirements would occur in all months in an average year under CP1 operations. Maximum change in monthly EC would not be greater than 2.1 percent under both Existing and Future conditions. Table 7-44 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Emmaton in the period of simulation. Operations of CP1 would not result in any additional violation of salinity standards between October and March. CP1 would result in an increase in the frequency of violations under Existing and Future Conditions during May, by up to 100 percent in all years and dry and critical years. However, CP1 would result in a decrease in the frequency of violations under Existing and Future Conditions during August and April, by up to 11.5 percent in all years and up to 50 percent during dry and critical years. Overall, the compliance of standards for the Sacramento River at Emmaton would be similar to the baseline levels under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-43. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Emmaton Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	2.0	0.0 (-0.9%)	2.4	0.0 (-0.3%)	2.0	0.0 (-1.2%)	2.5	0.0 (-0.8%)
November	1.5	0.0 (-0.1%)	2.2	0.0 (-0.5%)	1.5	0.0 (-0.4%)	2.3	0.0 (-1.0%)
December	1.0	0.0 (0.2%)	1.5	0.0 (0.3%)	0.9	0.0 (-0.5%)	1.5	0.0 (-1.1%)
January	0.5	0.0 (-0.2%)	0.7	0.0 (0.0%)	0.4	0.0 (0.9%)	0.7	0.0 (1.8%)
February	0.3	0.0 (1.0%)	0.4	0.0 (2.1%)	0.3	0.0 (0.9%)	0.4	0.0 (1.7%)
March	0.2	0.0 (0.3%)	0.3	0.0 (0.5%)	0.2	0.0 (0.6%)	0.3	0.0 (1.3%)
April	0.3	0.0 (0.0%)	0.3	0.0 (0.1%)	0.3	0.0 (-0.1%)	0.4	0.0 (-0.2%)
May	0.3	0.0 (0.1%)	0.5	0.0 (0.2%)	0.3	0.0 (-0.4%)	0.6	0.0 (-0.7%)
June	0.6	0.0 (0.2%)	1.1	0.0 (0.3%)	0.6	0.0 (0.0%)	1.1	0.0 (-0.1%)
July	0.7	0.0 (-0.1%)	1.3	0.0 (-0.1%)	0.8	0.0 (-0.2%)	1.4	0.0 (-0.4%)
August	1.4	0.0 (-0.4%)	2.3	0.0 (-0.8%)	1.5	0.0 (-0.4%)	2.3	0.0 (-0.8%)
September	1.6	0.0 (-1.4%)	3.0	-0.1 (-2.0%)	1.6	0.0 (-1.6%)	3.1	-0.1 (-2.3%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-44. Simulated Number of Months of Exceedence of the Salinity Standard for the San Sacramento River at Emmaton Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	1	0.0 (0.0%)	1	0.0 (0.0%)	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	1.0 (100.0%)	1	1.0 (100.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
June	28	0.0 (0.0%)	18	0.0 (0.0%)	27	0.0 (0.0%)	19	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	69	-3.0 (-4.3%)	26	-3.0 (-11.5%)	70	-3.0 (-4.3%)	26	-3.0 (-11.5%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19d (CP1): Delta Salinity on the Old River at Rock Slough On an average annual basis, all months except September through January under both the Existing Condition and Future Condition would be less than 150 mg/L. Change in chloride concentration would not affect compliance with the standard as it would already be exceeded under the basis of comparison. This impact would be less than significant.

Rock Slough is the location of the CCWD diversion for the Contra Costa Canal. The actual requirement location is at Contra Costa Canal Pumping Plant No. 1, but in DSM2, the location is measured in the Old River at Rock Slough. The requirements, as defined in D-1641, specify a minimum number of days during the calendar year that the maximum mean daily chloride concentration of 150 mg/L must be maintained. Objectives for the Contra Costa Canal Pumping Plant No. 1 are defined in Table 7-13.

Table 7-45 shows simulated monthly average chloride concentrations and percent change for the Old River at Rock Slough. On an average annual basis, CP1 would not increase chloride concentrations by more than 1.1 percent. Maximum changes in chloride concentrations under the CP1 are less than 2.1 percent for dry and critical years.

Table 7-46 shows the average number of days in a year simulated chloride values exceeded the standard of 150 mg/L for the Old River at Rock Slough. No additional daily violations of the chloride standards are shown to occur under both existing and future conditions for CP1, as compared with baseline conditions. Overall, CP1 would not alter the compliance level for Old River at Rock Slough observed under both Existing and Future conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-45. Simulated Monthly Average Chlorides and Percent Change for the Old River at Rock Slough Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP1 Change (mg/L (%))	Existing Condition (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))
October	156.2	-0.1 (-0.1%)	175.6	-0.9 (-0.5%)	157.1	0.0 (0.0%)	176.7	-0.9 (-0.5%)
November	154.9	-0.5 (-0.3%)	177.7	-0.1 (-0.1%)	155.3	0.3 (0.2%)	181.1	-0.3 (-0.2%)
December	144.3	1.6 (1.1%)	178.3	1.1 (0.6%)	151.7	0.4 (0.2%)	186.7	0.9 (0.5%)
January	153.9	1.2 (0.8%)	183.5	3.1 (1.7%)	164.9	0.7 (0.4%)	197.1	1.6 (0.8%)
February	106.2	0.8 (0.7%)	112.3	2.4 (2.1%)	119.2	0.8 (0.6%)	115.5	1.9 (1.6%)
March	95.2	0.1 (0.1%)	92.3	1.1 (1.2%)	103.8	0.5 (0.5%)	95.6	1.2 (1.3%)
April	88.4	-0.4 (-0.4%)	86.6	0.2 (0.3%)	90.0	0.3 (0.3%)	85.4	0.6 (0.7%)
May	90.4	-0.2 (-0.2%)	92.3	0.1 (0.1%)	87.5	0.1 (0.1%)	87.2	0.1 (0.1%)
June	62.4	0.0 (0.1%)	75.8	0.1 (0.1%)	61.5	0.0 (0.0%)	75.4	0.0 (0.0%)
July	73.8	0.3 (0.3%)	111.3	0.7 (0.6%)	76.6	0.3 (0.4%)	115.5	0.6 (0.5%)
August	117.0	0.4 (0.4%)	182.4	1.0 (0.5%)	122.0	0.3 (0.3%)	186.3	1.2 (0.7%)
September	158.5	0.2 (0.2%)	210.3	0.4 (0.2%)	167.1	0.0 (0.0%)	208.4	0.4 (0.2%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006) converted to chlorides using the equation EC*0.268-24.*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-46. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Old River at Rock Slough Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	17	0 (0%)	7	0 (0%)	17	0 (0%)	7	0 (0%)
November	16	0 (0%)	7	0 (0%)	16	0 (0%)	7	0 (0%)
December	14	0 (0%)	7	0 (0%)	15	0 (0%)	7	0 (0%)
January	13	0 (0%)	7	0 (0%)	16	0 (0%)	8	0 (0%)
February	5	0 (0%)	2	0 (0%)	7	0 (0%)	2	0 (0%)
March	3	0 (0%)	1	0 (0%)	5	0 (0%)	0	0 (0%)
April	1	0 (0%)	0	0 (0%)	1	0 (0%)	0	0 (0%)
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	3	0 (0%)	3	0 (0%)	3	0 (0%)	3	0 (0%)
August	10	0 (0%)	10	0 (0%)	11	0 (0%)	10	0 (0%)
September	18	0 (0%)	11	0 (0%)	20	0 (0%)	11	0 (0%)
Total	99	0 (0%)	54	0 (0%)	111	0 (0%)	56	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RHCCC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Impact WQ-19e (CP1): Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. Both requirements would continue to be met under CP1 under both Existing and Future conditions. This impact would be less than significant.

Table 7-16 shows both the chloride and EC thresholds that must be met at Jones Pumping Plant. Tables 7-47 and 7-48 show that CP1 would not exceed chloride thresholds. All increases in chloride concentrations would be less than 5 percent under CP1. Tables 7-49 and 7-50 show that increases in EC would be less than 1.0 percent under CP1 and would not exceed the EC threshold. CP1 would not change the baseline compliance levels under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-47. Simulated Monthly Average Chlorides and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP1 Change (mg/L (%))	Existing Condition (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))
October	107.1	-0.2 (-0.2%)	117.9	-0.5 (-0.4%)	105.1	-0.3 (-0.2%)	117.0	-0.9 (-0.8%)
November	105.8	0.0 (0.0%)	118.9	0.0 (0.0%)	103.1	0.1 (0.1%)	118.4	-0.3 (-0.3%)
December	124.1	1.0 (0.8%)	142.3	0.8 (0.6%)	118.1	0.5 (0.4%)	136.7	0.6 (0.5%)
January	141.4	0.2 (0.1%)	165.9	0.5 (0.3%)	129.5	0.2 (0.2%)	151.2	0.7 (0.5%)
February	123.6	0.5 (0.4%)	159.4	1.2 (0.7%)	113.7	0.0 (0.0%)	148.2	0.3 (0.2%)
March	106.9	-0.3 (-0.3%)	157.9	0.1 (0.1%)	97.1	0.4 (0.4%)	146.9	0.9 (0.6%)
April	84.0	0.0 (0.0%)	123.4	0.1 (0.1%)	68.6	0.1 (0.2%)	108.4	0.4 (0.3%)
May	75.3	0.0 (0.0%)	106.4	-0.1 (0.0%)	66.0	0.0 (0.0%)	97.7	0.0 (0.0%)
June	66.4	0.0 (0.0%)	81.4	0.1 (0.1%)	60.8	-0.1 (-0.1%)	75.6	0.1 (0.2%)
July	60.8	0.2 (0.4%)	83.1	0.7 (0.8%)	58.8	0.2 (0.3%)	82.1	0.4 (0.4%)
August	82.2	0.3 (0.4%)	121.9	0.7 (0.6%)	80.6	0.3 (0.4%)	121.2	1.0 (0.9%)
September	109.5	0.3 (0.3%)	145.0	0.7 (0.5%)	107.5	0.1 (0.1%)	141.7	0.5 (0.4%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mg/L = milligrams per liter

Table 7-48. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: , Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-49. Simulated Monthly Average Salinity and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.6	0.0 (-0.2%)	0.6	0.0 (-0.3%)	0.5	0.0 (-0.2%)	0.6	0.0 (-0.6%)
November	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.1%)	0.6	0.0 (-0.2%)
December	0.6	0.0 (0.6%)	0.7	0.0 (0.4%)	0.6	0.0 (0.3%)	0.7	0.0 (0.3%)
January	0.7	0.0 (0.1%)	0.8	0.0 (0.3%)	0.6	0.0 (0.1%)	0.7	0.0 (0.4%)
February	0.6	0.0 (0.3%)	0.7	0.0 (0.6%)	0.6	0.0 (0.0%)	0.7	0.0 (0.2%)
March	0.6	0.0 (-0.2%)	0.7	0.0 (0.1%)	0.5	0.0 (0.3%)	0.7	0.0 (0.5%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.1%)	0.4	0.0 (0.1%)	0.6	0.0 (0.2%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.4	0.0 (0.0%)	0.5	0.0 (0.1%)	0.4	0.0 (-0.1%)	0.4	0.0 (0.1%)
July	0.4	0.0 (0.2%)	0.5	0.0 (0.5%)	0.4	0.0 (0.2%)	0.5	0.0 (0.3%)
August	0.5	0.0 (0.2%)	0.6	0.0 (0.4%)	0.5	0.0 (0.3%)	0.6	0.0 (0.6%)
September	0.6	0.0 (0.2%)	0.7	0.0 (0.4%)	0.6	0.0 (0.1%)	0.7	0.0 (0.3%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-50. Simulated Number of Months of Exceedence of the Salinity Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19f (CP1): Delta Water Quality on the West Canal at the Mouth of the Clifton Court Forebay The 250 mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under CP1. CP1 would also not exceed EC thresholds. This impact would be less than significant.

Clifton Court Forebay is the source of water supply for the Banks Pumping Plant and SWP exports south of the Delta. Similar to the Delta-Mendota Canal at Jones Pumping Plant, the water quality requirement on the West Canal at the mouth of the Clifton Court Forebay has two components, a chloride requirement and an EC requirement. Table 7-21 shows both the chloride and EC concentration requirements.

Table 7-51 shows that maximum chloride concentrations under both existing and future project conditions are lower for CP1 than the 250 mg/L threshold. Maximum changes under both existing and future projection conditions are less than 1.5 percent. As shown in Table 7-52, CP1 the maximum change in EC values under existing and future project conditions would be less than 1.5 percent.

Table 7-51. Simulated Monthly Average Chlorides and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP1 Change (mg/L (%))	Existing Condition (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))	No-Action Alternative (mg/L)	CP1 Change (mg/L (%))
October	110.8	-0.3 (-0.3%)	124.3	-0.7 (-0.5%)	110.4	-0.1 (-0.1%)	125.1	-0.9 (-0.7%)
November	107.2	0.2 (0.2%)	123.4	0.1 (0.1%)	105.7	0.4 (0.4%)	124.8	0.0 (0.0%)
December	109.2	1.6 (1.4%)	131.8	1.2 (0.9%)	107.0	0.8 (0.8%)	131.1	0.9 (0.7%)
January	128.1	0.7 (0.5%)	154.3	1.6 (1.0%)	120.5	0.4 (0.3%)	145.3	1.0 (0.7%)
February	107.5	0.5 (0.5%)	134.7	1.4 (1.1%)	99.2	0.3 (0.3%)	124.2	1.0 (0.8%)
March	91.9	-0.2 (-0.2%)	132.1	0.5 (0.4%)	83.6	0.5 (0.6%)	122.4	1.4 (1.1%)
April	75.6	0.0 (0.0%)	110.3	0.2 (0.2%)	60.8	0.2 (0.4%)	96.4	0.6 (0.7%)
May	70.8	0.0 (0.0%)	99.9	0.0 (0.0%)	61.6	0.0 (0.1%)	91.6	0.1 (0.1%)
June	56.4	0.0 (0.0%)	73.4	0.1 (0.1%)	51.8	-0.1 (-0.1%)	68.6	0.1 (0.1%)
July	52.2	0.3 (0.5%)	82.6	0.8 (1.0%)	51.3	0.2 (0.3%)	82.3	0.3 (0.4%)
August	80.5	0.2 (0.3%)	128.2	0.5 (0.4%)	80.4	0.3 (0.4%)	127.5	1.1 (0.9%)
September	115.0	0.3 (0.3%)	157.5	0.7 (0.4%)	114.9	0.2 (0.2%)	154.7	0.7 (0.5%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L= milligrams per liter

Table 7-52. Simulated Monthly Average Salinity and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.6	0.0 (-0.2%)	0.6	0.0 (-0.4%)	0.6	0.0 (-0.1%)	0.6	0.0 (-0.5%)
November	0.6	0.0 (0.2%)	0.6	0.0 (0.1%)	0.5	0.0 (0.3%)	0.6	0.0 (0.0%)
December	0.6	0.0 (1.0%)	0.6	0.0 (0.7%)	0.6	0.0 (0.5%)	0.6	0.0 (0.5%)
January	0.6	0.0 (0.4%)	0.7	0.0 (0.8%)	0.6	0.0 (0.2%)	0.7	0.0 (0.5%)
February	0.6	0.0 (0.4%)	0.7	0.0 (0.8%)	0.5	0.0 (0.2%)	0.6	0.0 (0.6%)
March	0.5	0.0 (-0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.4%)	0.6	0.0 (0.8%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.1%)	0.4	0.0 (0.2%)	0.5	0.0 (0.5%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.1%)
June	0.4	0.0 (0.0%)	0.4	0.0 (0.1%)	0.4	0.0 (-0.1%)	0.4	0.0 (0.1%)
July	0.4	0.0 (0.3%)	0.5	0.0 (0.6%)	0.3	0.0 (0.2%)	0.5	0.0 (0.3%)
August	0.5	0.0 (0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.2%)	0.6	0.0 (0.6%)
September	0.6	0.0 (0.2%)	0.7	0.0 (0.4%)	0.6	0.0 (0.1%)	0.7	0.0 (0.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-53 shows the average number of days simulated chloride values exceeded the standards of 250 mg/L for the West Canal at the Clifton Court Forebay in a year. There would be no additional violations throughout the year for average annual or dry and critical years, under both existing and future project conditions. CP1 would not change the baseline compliance levels under both Existing and Future conditions.

As shown in Table 7-54, CP1 would not result in any additional violations of the salinity standards. CP1 would actually result in decreases in EC during several months of the year. CP1 would not change the baseline compliance levels under both Existing and Future conditions.

The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-53. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:

Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:

CP = Comprehensive Plan

Table 7-54. Simulated Number of Months of Exceedence of the Salinity Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months (%))	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)
November	0	1.0 (0.0%)	0	0.0 (0.0%)	3	-2.0 (-66.7%)	2	-1.0 (-50.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	2	-1.0 (-50.0%)	1	0.0 (0.0%)
January	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19g (CP1): Delta Salinity on the San Joaquin River at Vernalis On an average monthly basis, EC would meet requirements in all months, in both average years and in dry and critical years. Moreover, CP1 would not exceed EC thresholds on the San Joaquin River at Vernalis. This impact would be less than significant.

To protect water quality in the south Delta, D-1641 includes a salinity objective at several locations on the San Joaquin River and on the Old River. The objective is the same for all four locations: the San Joaquin River at Airport Way Bridge in Vernalis, the San Joaquin River at Brandt Bridge, the Old River near the Middle River, and the Old River at Tracy Road Bridge. The water quality requirement is a maximum 30-day average of mean daily EC. Table 7-26 shows the south Delta water quality requirement.

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP1 would not exceed EC thresholds on the San Joaquin River at Vernalis, as shown in Tables 7-55 and 7-56. CP1 would not change the baseline compliance levels under both Existing and Future conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-55. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Vernalis Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-56. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Vernalis Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	3	0.0 (0.0%)	3	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19h (CP1): Delta Salinity on the San Joaquin River at Brandt Bridge On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP1 would not change EC on the San Joaquin River at Brandt Bridge. This impact would be less than significant.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the San Joaquin River at Brandt Bridge. Table 7-26 details water quality requirement standards for salinity.

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-57. Table 7-58 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Brandt Bridge in the period of simulation. CP1 would not change the existing compliance level under both existing and future project conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-57. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.1%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN072)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-58. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN072)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19i (CP1): Delta Salinity on the Old River near the Middle River

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP1 would not measurably change EC on the Old River near the Middle River. This impact would be less than significant.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the Old River near the Middle River. Table 7-26 details water quality requirement standards for salinity.

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-59. Table 7-60 shows the number of months simulated EC values exceeded the standards for the Old River near the Middle River in the period of simulation. Compliance with salinity standards for the Old River near the Middle River would not change under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-59. Simulated Monthly Average Salinity and Percent Change for the Old River near the Middle River Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-60. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River near the Middle River Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19j (CP1): Delta Salinity on the Old River at Tracy Road Bridge

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years under CP1. CP1 would not measurably change EC on the Old River at Tracy Road Bridge. This impact would be less than significant.

As previously mentioned, D-1641 contains a south Delta water quality requirement applicable at several locations, including on the Old River at Tracy Road Bridge. Table 7-26 details water quality requirement standards for salinity.

CP1 would not measurably change EC on the Old River at Tracy Road Bridge, as shown in Table 7-61. Table 7-62 shows the number of months simulated EC values exceeded the standards for the Old River near Tracy Road Bridge in the period of simulation. Although exceedence would occur during August, under future conditions, on an annual average basis, the compliance of salinity standards under CP1 would not change from the Existing Conditions. CP1 would not alter the compliance level for the Old River near Tracy Road Bridge observed under both Existing and Future conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-61. Simulated Monthly Average Salinity and Percent Change for the Old River at Tracy Road Bridge Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP1 Change (mmhos/cm (%))
October	0.5	0.0 (0.2%)	0.6	0.0 (0.2%)	0.5	0.0 (0.1%)	0.5	0.0 (-0.1%)
November	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (-0.1%)	0.7	0.0 (-0.3%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (-0.1%)	0.6	0.0 (-0.3%)	0.6	0.0 (0.1%)	0.6	0.0 (0.3%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.1%)	0.6	0.0 (0.2%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-62. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Tracy Road Bridge Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP1 Change	Existing Condition	CP1 Change	No-Action Alternative	CP1 Change	No-Action Alternative	CP1 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	7	0.0 (0.0%)	7	0.0 (0.0%)	5	0.0 (0.0%)	5	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	4	0.0 (0.0%)	4	0.0 (0.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index. Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Impact WQ-20 (CP1): X2 Position CP1 would not change average monthly X2 in either average years or in dry and critical years by more than 0.1 kilometer (km) under either the Existing Condition or Future Condition. Although several months may be out of compliance individually under the bases of comparison, the impact would be less than significant.

Table 7-63 shows the simulated monthly average X2 position for CP1 compared to the Existing Condition and Future Condition baselines. CalSim-II calculates the X2 position on a 1-month delay; the values shown have been corrected to accurately reflect the X2 position for the specified month.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-63. Simulated Monthly Average X2 Position Under Baseline Conditions and CP1

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (km)	CP1 Change (km (%))	Existing Condition (km)	CP1 Change (km (%))	No-Action Alternative (km)	CP1 Change (km (%))	No-Action Alternative (km)	CP1 Change (km (%))
October	83.9	0.0 (0.0%)	86.6	0.0 (0.0%)	83.9	0.0 (0.0%)	86.5	0.0 (0.0%)
November	82.2	0.1 (0.1%)	86.5	0.0 (0.0%)	82.2	0.1 (0.1%)	86.6	0.0 (0.0%)
December	76.1	0.1 (0.1%)	84.8	0.1 (0.1%)	76.0	0.0 (0.1%)	84.7	0.0 (0.0%)
January	67.5	0.0 (0.0%)	79.6	0.0 (0.0%)	67.3	0.0 (0.1%)	79.2	0.1 (0.2%)
February	60.9	0.0 (0.0%)	72.5	0.0 (0.0%)	60.8	0.0 (0.1%)	72.3	0.1 (0.1%)
March	60.9	0.0 (0.0%)	70.3	0.0 (0.0%)	60.9	0.0 (0.0%)	70.3	0.0 (0.0%)
April	63.5	0.0 (0.0%)	72.9	0.0 (0.0%)	63.4	0.0 (0.0%)	73.0	0.0 (0.0%)
May	67.5	0.0 (0.0%)	77.6	0.0 (0.0%)	67.7	0.0 (0.0%)	78.0	-0.1 (-0.1%)
June	74.5	0.0 (0.0%)	82.6	0.0 (0.0%)	74.7	0.0 (0.0%)	82.8	0.0 (0.0%)
July	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)
August	85.6	0.0 (0.0%)	88.8	0.0 (0.0%)	85.6	0.0 (0.0%)	88.6	0.0 (0.0%)
September	82.6	0.0 (0.0%)	91.1	0.0 (-0.1%)	82.6	0.0 (0.0%)	90.9	-0.1 (-0.1%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node X2_PRV)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
km = kilometer
X2 = geographic location of 2 parts per thousand near-bottom salinity isohaline in the Delta, measured in distance upstream from Golden Gate Bridge in Suisun Bay.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

As with CP1, CP2 focuses on increasing water supply reliability and increasing anadromous fish survival. CP2 primarily consists of raising Shasta Dam by 12.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 14.5 feet and enlarge the total storage capacity in the reservoir by 443,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 120 TAF and 60 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP2 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Shasta Lake and Vicinity

Impact WQ-1 (CP2): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-1 (CP1). However, the construction-related activities described in Chapter 2, "Alternatives," would result in about 500 more acres of exposed shoreline than CP1. Relocation activities under CP2 would expose a similar but greater acreage to erosion than would CP1 (up to 3,337 acres). This alternative is similar to, but somewhat larger than CP1. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-2 (CP2): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses Similar to CP1, construction activities associated with enlarging Shasta Dam as well as the relocation actions would result in sizeable areas that would be subject to surface disturbance, including jurisdictional waters within the influence zone of CP2. Efforts to document jurisdictional waters associated with relocation areas are ongoing. This information will be included, if available, in the Final EIS, as well as in the Section 404 permitting package, before issuance of a ROD.

Environmental commitments and BMPs for the various construction and relocation activities (e.g., bridge replacement, boat ramp construction, demolition of facilities) have been incorporated into CP2. These activities could include removal of riparian vegetation, thereby exposing water bodies to increased solar radiation for various time periods. A riparian revegetation program will be implemented at all construction and relocation sites as applicable to ensure that shade is quickly reestablished after construction is completed.

As described in Chapter 2, “Alternatives,” although the TCD may not be operational for some period of time during construction, project sequencing will ensure that changes to water temperature and associated limnological conditions will be consistent with those that occur periodically under the No-Action Alternative associated with maintenance and outage periods.

Because of the large water surface area of Shasta Lake, coupled with the isolated and discrete nature of the relocation activities on the tributaries, temporary construction-related effects are not expected to modify water temperature in a manner that would have a negative effect on beneficial uses or result in a water quality violation. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-3 (CP2): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-3 (CP1). There would be no construction activities that would disturb locations known to contain elevated metal concentrations in either sediments or the water column. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-4 (CP2): Long-Term Sediment Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact is similar to WQ-4 (CP1), except that the exposure of an additional 1,735 acres of shoreline surrounding Shasta Lake would result in a potential for increased wave-related shoreline erosion (see Chapter 4, “Geology, Geomorphology, Minerals, and Soils”). This would be a potentially significant impact. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-5 (CP2): Long-Term Temperature Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to CP1, this alternative would increase storage on a monthly basis although it would vary by water year. This impact would be less than significant.

Table 7-64 shows the simulated monthly change in storage for CP2 as a percent increase above the No-Action Alternative. On average, CP2 would provide an approximately 10 percent increase in the end-of-month storage on an annual basis.

Table 7-64. Simulated Average Increased End-of-Month Shasta Lake Storage – CP2

Month	Existing Conditions (TAF)	CP2 (TAF)	CP2 % Increase
October	2,592	282	10.9%
November	2,568	271	10.6%
December	2,722	295	10.8%
January	2,995	310	10.3%
February	3,267	326	10.0%
March	3,625	334	9.2%
April	3,916	328	8.4%
May	3,941	330	8.4%
June	3,639	327	9.0%
July	3,160	315	10.0%
August	2,834	312	11.0%
September	2,669	301	11.3%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)

Note:
Simulation period: 1922–2003

Key:
TAF = thousand acre-feet

Under CP2, existing water temperature requirements would typically be met in most years; therefore, the additional increase in water storage shown in Table 7-64 would primarily be released for water supply purposes. Accordingly, minimal increases in releases from Shasta Dam would be expected in months when Delta exports are constrained, or when flow is not usable for water supply purposes.

Similar to CP1, the increase in storage provided by CP2 fluctuates greatly throughout a year. A key indicator of water temperature benefits of CP2 to the upper Sacramento River between Keswick Dam and Red Bluff is the amount of cold water available in Shasta Lake before the water temperature operation season, about May through October. Similar to CP1, the CWP volume in the lake accumulates during the winter and early spring and is not likely to increase after April. Therefore, the expected increase in spring storage for CP2 should also result in an incremental increase in the CWP volume.

The simulated end-of-April volume of water with a temperature lower than 52°F for the No-Action Alternative and the change in CWP volume for CP2 is shown, by SVI year type, in Table 7-65.

Table 7-65. Simulated Average Volume of Water Less than 52°F in Shasta Lake at the End of April – CP2

SVI Year Type	Existing Conditions (TAF)	CP2 (TAF)	% Increase
Average of All Years	2,609	267	10%
Wet	2,804	331	12%
Above Normal	2,972	296	10%
Below Normal	2,699	263	10%
Dry	2,542	231	9%
Critical	1,601	134	8%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations

Note:
Simulation period: 1922-2003
Year types as defined by the Sacramento Valley Index

Key:
SVI = Sacramento Valley Index
TAF = thousand acre-feet

In addition to illustrating the average change in available CWP, Table 7-65 also shows the influence of climatic conditions on these values. The diversity between water year types, coupled with unique combinations of storage and rainfall would continue to influence the ability to manage storage in Shasta Lake to maximize carryover capacity. An increase in active storage and carryover storage of the CWP would occur. However, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-6 (CP2): Long-Term Metals Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to CP1, the increase in storage associated with this alternative would not result in modifying the depth and thickness of the thermocline that persists in Shasta Lake. This impact would be less than significant.

Within the Squaw Creek Arm, two depositional features associated with historic copper mining and smelting operations are immediately adjacent to the shoreline of Shasta Lake in the general vicinity of the Bully Hill Mine. As mapped, these two sites appear to have about 7,300 cubic yards of material that could be subjected to shoreline and surficial erosional processes at slightly higher elevations on the features than CP1with a high potential for delivery to Shasta Lake. This impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (CP2): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction would include ground-disturbing activities that could result in soil erosion and sediment effects on the upper Sacramento River. This impact would be potentially significant.

Similar to Impact WQ-7 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-8 (CP2): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in temperature effects on the upper Sacramento River because changes to water temperature in Shasta Lake and subsequent releases to the Sacramento River would be consistent with typical periodic fluctuations. This impact would be less than significant.

This impact would be identical to Impact WQ-8 (CP1). For the same reasons as described for Impact WQ-8 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-9 (CP2): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in water quality effects on the upper Sacramento River related to metals because construction would not disturb locations of known elevated metal concentrations. This impact would be less than significant.

This impact would be identical to Impact WQ-9 (CP1). For the same reasons described for Impact WQ-9 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-10 (CP2): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River No long-term water quality impacts are anticipated in the upper Sacramento River in regard to sediment, because modeling results have indicated that CP2 would cause little change in average mean monthly winter flows during some years, which could slightly reduce sediment transport. This impact would be less than significant.

This impact would be similar to Impact WQ-10 (CP1) because the extent of the effect of CP2 on sediment would be similar to but slightly greater than that for CP1 (i.e., CP2 would have greater potential to reduce erosional processes and sediment transport in the upper Sacramento River). For the same reasons as described for Impact WQ-10 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-11 (CP2): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Analysis of temperature modeling results indicates that CP2 would improve compliance with the temperature requirements on the Sacramento River because of the increased depth of the cold-water pool in Shasta Lake and the associated enhanced ability to regulate water temperature releases to the upper Sacramento River. Therefore, the impact of CP2 on water quality measured as temperature would be beneficial.

CP2 would increase the ability of Shasta Dam to release cold water and regulate water temperature in the upper Sacramento River, primarily in dry and critical years. Raising Shasta Dam 12.5 feet would increase the cold-water pool and benefit seasonal water temperatures along the upper Sacramento River. This section focuses on compliance with water quality standards for temperature. For an analysis of temperature effects on fisheries and aquatic habitat, see Chapter 11, “Fisheries and Aquatic Resources.”

Analysis of temperature modeling results indicates that under both existing and future conditions, CP2 would have a beneficial effect on temperature within the upper Sacramento River, with a slight decrease in average monthly water temperature during summer. Decreased temperatures would improve compliance with the temperature objectives for the upper Sacramento River in the 2004 and 2009 BOs (NMFS 2004, 2009). CP2 would reduce temperature exceedences at Balls Ferry by 15 percent under existing conditions and 19 percent under future conditions. At the Bend Bridge compliance station, CP2 would reduce temperature exceedences by 6 percent under existing conditions and 8 percent under future conditions. Table 7-38 summarizes the temperature modeling results.

Based on this analysis, the impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-12 (CP2): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Long-term operation of the project could result in water quality effects on the upper Sacramento River in regard to metals as a result of erosional processes to historic mining and smelting operation features. This impact would be potentially significant.

This impact would be similar to Impact WQ-12 (CP1) because the extent of the effect of CP2 on metals would be similar to but slightly greater than that for CP1. For the same reasons as described for CP1, this impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas
CP2 would differ from the No-Action Alternative primarily through a 443 TAF enlargement of Shasta Lake. The impacts described below are the same as described for CP1.

Impact WQ-13 (CP2): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards

Construction is not anticipated to affect water quality conditions in the extended study area. This impact would be less than significant.

This impact would be similar to Impact WQ-13 (CP1). For the same reasons as described for Impact WQ-13 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-14 (CP2): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-14 (CP1). For the same reasons as described for Impact WQ-14 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-15 (CP2): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-15 (CP1). For the same reasons as described for Impact WQ-15 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-16 (CP2): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Project implementation could affect water quality in the extended study area, but effects would diminish with distance. This impact would be less than significant.

This impact would be similar to Impact WQ-16 (CP1). For the same reasons as described for Impact WQ-16 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-17 (CP2): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-17 (CP1). Analysis of temperature modeling shows little to no change in temperature at RBPP caused by CP2. This suggests that there would be no changes in temperature beyond RBPP as a result of CP2. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-18 (CP2): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-18 (CP1). For the same reasons as described for Impact WQ-18 (CP1), this impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-19a (CP2): Delta Salinity on the Sacramento River at Collinsville This impact would be similar to Impact WQ-19a (CP1). As shown in Table

7-66, operations for CP2 result in both increases and decreases in salinity; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

Table 7-67 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Collinsville in the period of simulation. The operation of CP2 would not result in any violation of the salinity standards under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-66. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Collinsville Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	6.0	-0.1 (-1.0%)	7.1	-0.1 (-0.8%)	6.0	-0.1 (-1.0%)	7.1	-0.1 (-0.9%)
November	5.1	0.0 (0.0%)	6.8	0.0 (-0.7%)	5.1	0.0 (-0.1%)	6.9	-0.1 (-0.9%)
December	3.6	0.0 (-0.6%)	5.5	-0.1 (-1.3%)	3.6	0.0 (-0.4%)	5.5	0.0 (-0.7%)
January	1.8	0.0 (0.4%)	3.4	0.0 (1.0%)	1.7	0.0 (-0.1%)	3.3	0.0 (0.3%)
February	0.8	0.0 (2.5%)	1.7	0.1 (3.9%)	0.8	0.0 (0.0%)	1.6	0.0 (0.4%)
March	0.6	0.0 (0.4%)	1.2	0.0 (0.2%)	0.6	0.0 (0.0%)	1.1	0.0 (-0.1%)
April	0.7	0.0 (0.0%)	1.4	0.0 (-0.1%)	0.7	0.0 (-1.0%)	1.5	0.0 (-1.4%)
May	1.1	0.0 (0.0%)	2.3	0.0 (0.1%)	1.1	0.0 (-0.8%)	2.4	0.0 (-1.0%)
June	2.2	0.0 (0.3%)	4.0	0.0 (0.3%)	2.2	0.0 (0.1%)	4.1	0.0 (0.0%)
July	3.2	0.0 (0.0%)	5.3	0.0 (-0.2%)	3.2	0.0 (0.1%)	5.5	0.0 (-0.1%)
August	5.3	0.0 (-0.3%)	7.3	0.0 (-0.7%)	5.4	0.0 (-0.3%)	7.4	0.0 (-0.7%)
September	5.2	0.0 (-0.7%)	8.8	-0.1 (-1.1%)	5.2	-0.1 (-1.3%)	8.8	-0.2 (-2.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-67. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Collinsville Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP2 Change (Number of months (%))	Existing Condition (Number of months)	CP2 Change (Number of months (%))	No-Action Alternative (Number of months)	CP2 Change (Number of months (%))	No-Action Alternative (Number of months)	CP2 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922–2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19b (CP2): Delta Salinity on the San Joaquin River at Jersey Point
Impact WQ-19b (CP2) would be similar to Impact WQ-19b (CP1). As shown in Table 7-68, the basis of comparison would meet the requirement on an average basis in both average years and in dry and critical years. Furthermore, all changes during April through August would be less than 2 percent. This impact would be less than significant.

Table 7-69 shows the number of months simulated EC values exceeded the standards for San Joaquin River at Jersey Point in the period of simulation. CP2 would result in an increase in the frequency of violations under Existing Conditions during June, by 10 percent in all years and 12.5 percent during dry and critical years. However, the EC standards are not violated on an average monthly basis. Overall, frequency of violation of salinity standards for the San Joaquin River at Jersey Point under CP2 would be similar to those under Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-68. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Jersey Point Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	1.6	0.0 (-0.5%)	1.8	0.0 (-1.1%)	1.6	0.0 (-0.5%)	1.9	0.0 (-0.7%)
November	1.5	0.0 (1.8%)	1.8	0.0 (1.1%)	1.5	0.0 (1.4%)	1.8	0.0 (0.9%)
December	1.2	0.0 (0.4%)	1.8	0.0 (-0.7%)	1.2	0.0 (0.0%)	1.7	0.0 (-0.8%)
January	0.7	0.0 (0.6%)	1.1	0.0 (1.3%)	0.7	0.0 (0.9%)	1.0	0.0 (2.0%)
February	0.3	0.0 (3.5%)	0.5	0.0 (6.8%)	0.3	0.0 (1.9%)	0.5	0.0 (3.8%)
March	0.3	0.0 (0.8%)	0.3	0.0 (2.0%)	0.3	0.0 (0.4%)	0.3	0.0 (0.9%)
April	0.3	0.0 (0.0%)	0.3	0.0 (0.2%)	0.3	0.0 (-0.1%)	0.3	0.0 (-0.2%)
May	0.3	0.0 (0.0%)	0.4	0.0 (0.1%)	0.3	0.0 (0.0%)	0.4	0.0 (0.0%)
June	0.4	0.0 (0.3%)	0.7	0.0 (0.3%)	0.4	0.0 (0.2%)	0.7	0.0 (0.2%)
July	1.0	0.0 (0.5%)	1.7	0.0 (0.7%)	1.0	0.0 (1.1%)	1.7	0.0 (1.7%)
August	1.6	0.0 (-0.1%)	2.2	0.0 (-0.2%)	1.6	0.0 (0.1%)	2.1	0.0 (0.5%)
September	1.9	0.0 (0.3%)	2.8	0.0 (0.6%)	1.9	0.0 (0.6%)	2.8	0.0 (1.1%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-69. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Jersey Point Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	10	1.0 (10.0%)	8	1.0 (12.5%)	13	0.0 (0.0%)	11	0.0 (0.0%)
July	51	0.0 (0.0%)	22	0.0 (0.0%)	50	1.0 (2.0%)	21	1.0 (4.8%)
August	73	0.0 (0.0%)	25	0.0 (0.0%)	76	-2.0 (-2.6%)	27	-2.0 (-7.4%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19c (CP2): Delta Salinity on the Sacramento River at Emmaton

Impact WQ-19c (CP2) would be similar to Impact WQ-19c (CP1). Operations for CP2 would result in both increases and decreases in salinity in comparison to baseline conditions; however, none of the increases would be sufficient to change compliance for the Sacramento River at Emmaton. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

Although Table 7-70 shows EC for all months, the Emmaton water quality requirement is only defined for April 1 through August 15. On an average monthly basis, EC requirements would be satisfied in all months in an average year under CP2 operations. Maximum change in monthly EC would not be greater than 5 percent under both Existing and Future conditions. Table 7-71 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Emmaton in the period of simulation. Operations of CP2 would not result in any violation of salinity standards between October and March. CP2 would result in an increase in the frequency of violations under Existing and Future Conditions during May, by up to 100 percent in all years and dry and critical years. However, CP2 would result in a decrease in the frequency of violations under Existing and Future Conditions during August and April, by up to 50 percent in all years and dry and critical years.

On an average monthly basis, the standards are not violated. Overall, the compliance of salinity standards for the Sacramento River at Emmaton would be very similar to the baseline levels under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-70. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Emmaton Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	2.0	0.0 (-1.9%)	2.4	0.0 (-1.6%)	2.0	0.0 (-2.0%)	2.5	0.0 (-1.7%)
November	1.5	0.0 (-0.9%)	2.2	0.0 (-1.7%)	1.5	0.0 (-1.1%)	2.3	0.0 (-2.1%)
December	1.0	0.0 (-1.7%)	1.5	0.0 (-3.0%)	0.9	0.0 (-0.9%)	1.5	0.0 (-1.5%)
January	0.5	0.0 (0.9%)	0.7	0.0 (1.9%)	0.4	0.0 (0.0%)	0.7	0.0 (0.4%)
February	0.3	0.0 (2.3%)	0.4	0.0 (4.7%)	0.3	0.0 (0.3%)	0.4	0.0 (0.8%)
March	0.2	0.0 (0.4%)	0.3	0.0 (0.8%)	0.2	0.0 (0.3%)	0.3	0.0 (0.6%)
April	0.3	0.0 (-0.1%)	0.3	0.0 (0.0%)	0.3	0.0 (-0.5%)	0.4	0.0 (-1.0%)
May	0.3	0.0 (0.0%)	0.5	0.0 (0.1%)	0.3	0.0 (-0.6%)	0.6	0.0 (-0.9%)
June	0.6	0.0 (0.3%)	1.1	0.0 (0.4%)	0.6	0.0 (0.2%)	1.1	0.0 (0.2%)
July	0.7	0.0 (-0.4%)	1.3	0.0 (-0.8%)	0.8	0.0 (-0.5%)	1.4	0.0 (-0.9%)
August	1.4	0.0 (-0.6%)	2.3	0.0 (-1.2%)	1.5	0.0 (-0.7%)	2.3	0.0 (-1.3%)
September	1.6	0.0 (-1.9%)	3.0	-0.1 (-2.7%)	1.6	-0.1 (-3.1%)	3.1	-0.1 (-4.3%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-71. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Emmaton Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP2 Change (Number of months (%))	Existing Condition (Number of months)	CP2 Change (Number of months (%))	No-Action Alternative (Number of months)	CP2 Change (Number of months (%))	No-Action Alternative (Number of months)	CP2 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	1	0.0 (0.0%)	1	0.0 (0.0%)	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	1.0 (100.0%)	1	1.0 (100.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
June	28	0.0 (0.0%)	18	0.0 (0.0%)	27	0.0 (0.0%)	19	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	69	-3.0 (-4.3%)	26	-3.0 (-11.5%)	70	-2.0 (-2.9%)	26	-2.0 (-7.7%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19d (CP2): Delta Salinity on the Old River at Rock Slough Impact WQ-19d (CP2) would be similar to Impact WQ-19d (CP1). On an average annual basis, chloride levels under both the Existing Condition and Future Condition would be less than 150 mg/L from February through July. This impact would be less than significant.

As shown in Table 7-72, in average annual years, CP2 would not increase chlorides by more than 1.3 percent. For dry and critical years, a maximum change of 2.3 percent in chloride concentration would occur. Change in chloride concentration would not affect compliance with the standard as it would already be exceeded under the basis of comparison. This impact would be less than significant.

Table 7-73 shows the number of days simulated chloride values exceeded the standards of 150 mg/L for the Old River at Rock Slough in the period of simulation. CP2 would result in no daily violations of the chloride standards under both existing and future conditions for CP2. Overall, CP2 would not alter the compliance level observed under the Existing and Future conditions.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-72. Simulated Monthly Average Chlorides and Percent Change for the Old River at Rock Slough Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP2 Change (mg/L (%))	Existing Condition (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))
October	156.2	-0.3 (-0.2%)	175.6	-1.1 (-0.6%)	157.1	-0.4 (-0.3%)	176.7	-0.9 (-0.5%)
November	154.9	-0.9 (-0.6%)	177.7	-1.7 (-0.9%)	155.3	-0.5 (-0.3%)	181.1	-1.0 (-0.6%)
December	144.3	1.9 (1.3%)	178.3	1.6 (0.9%)	151.7	0.0 (0.0%)	186.7	0.3 (0.2%)
January	153.9	1.2 (0.8%)	183.5	2.2 (1.2%)	164.9	0.6 (0.4%)	197.1	0.7 (0.4%)
February	106.2	0.8 (0.8%)	112.3	2.6 (2.3%)	119.2	1.1 (0.9%)	115.5	2.5 (2.1%)
March	95.2	0.2 (0.2%)	92.3	1.7 (1.9%)	103.8	0.9 (0.9%)	95.6	1.6 (1.7%)
April	88.4	-0.4 (-0.5%)	86.6	0.3 (0.4%)	90.0	0.3 (0.4%)	85.4	0.6 (0.6%)
May	90.4	-0.2 (-0.2%)	92.3	0.1 (0.1%)	87.5	0.1 (0.1%)	87.2	0.1 (0.1%)
June	62.4	0.0 (0.0%)	75.8	0.1 (0.1%)	61.5	0.0 (0.1%)	75.4	0.1 (0.2%)
July	73.8	0.3 (0.4%)	111.3	0.8 (0.7%)	76.6	0.5 (0.6%)	115.5	1.3 (1.1%)
August	117.0	0.2 (0.2%)	182.4	0.6 (0.4%)	122.0	0.7 (0.6%)	186.3	2.2 (1.2%)
September	158.5	-0.2 (-0.2%)	210.3	-0.4 (-0.2%)	167.1	-0.4 (-0.2%)	208.4	-0.4 (-0.2%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006) converted to chlorides using the equation EC*0.268-24*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-73. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Old River at Rock Slough Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	17	0 (0%)	7	0 (0%)	17	0 (0%)	7	0 (0%)
November	16	0 (0%)	7	0 (0%)	16	0 (0%)	7	0 (0%)
December	14	0 (0%)	7	0 (0%)	15	0 (0%)	7	0 (0%)
January	13	0 (0%)	7	0 (0%)	16	0 (0%)	8	0 (0%)
February	5	0 (0%)	2	0 (0%)	7	0 (0%)	2	0 (0%)
March	3	0 (0%)	1	0 (0%)	5	0 (0%)	0	0 (0%)
April	1	0 (0%)	0	0 (0%)	1	0 (0%)	0	0 (0%)
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	3	0 (0%)	3	0 (0%)	3	0 (0%)	3	0 (0%)
August	10	0 (0%)	10	0 (0%)	11	0 (0%)	10	0 (0%)
September	18	0 (0%)	11	0 (0%)	20	0 (0%)	11	0 (0%)
Total	99	0 (0%)	54	0 (0%)	111	0 (0%)	56	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Impact WQ-19e (CP2): Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant Impact WQ-19e (CP2) would be similar to Impact WQ-19e (CP1). The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. This impact would be less than significant.

Tables 7-74 and 7-75 show that CP2 would not exceed chloride thresholds. All increases in chloride concentrations would be less than 5 percent. Chloride values under CP2 would be similar to the baseline values under both Existing and Future conditions. Tables 7-76 and 7-77 show that increases in EC would be less than 5 percent under CP2 and would not exceed the EC threshold. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-74. Simulated Monthly Average Chlorides and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP2 Change (mg/L (%))	Existing Condition (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))
October	107.1	-0.5 (-0.4%)	117.9	-1.0 (-0.9%)	105.1	-0.6 (-0.6%)	117.0	-1.2 (-1.0%)
November	105.8	-0.2 (-0.2%)	118.9	-0.5 (-0.4%)	103.1	-0.5 (-0.5%)	118.4	-1.2 (-1.0%)
December	124.1	1.1 (0.9%)	142.3	0.9 (0.7%)	118.1	0.4 (0.4%)	136.7	0.4 (0.3%)
January	141.4	-0.3 (-0.2%)	165.9	-1.0 (-0.6%)	129.5	0.1 (0.0%)	151.2	0.3 (0.2%)
February	123.6	0.1 (0.1%)	159.4	0.2 (0.1%)	113.7	0.2 (0.2%)	148.2	0.6 (0.4%)
March	106.9	-0.5 (-0.5%)	157.9	-0.4 (-0.3%)	97.1	0.3 (0.4%)	146.9	0.9 (0.6%)
April	84.0	0.0 (0.0%)	123.4	0.1 (0.1%)	68.6	0.2 (0.3%)	108.4	0.5 (0.4%)
May	75.3	0.0 (0.0%)	106.4	0.0 (0.0%)	66.0	0.0 (0.0%)	97.7	0.0 (0.0%)
June	66.4	0.0 (-0.1%)	81.4	0.1 (0.2%)	60.8	0.0 (0.0%)	75.6	0.3 (0.4%)
July	60.8	0.3 (0.5%)	83.1	0.7 (0.9%)	58.8	0.3 (0.6%)	82.1	0.8 (1.0%)
August	82.2	0.4 (0.4%)	121.9	1.0 (0.8%)	80.6	0.5 (0.6%)	121.2	1.6 (1.3%)
September	109.5	0.1 (0.1%)	145.0	0.5 (0.4%)	107.5	0.0 (0.0%)	141.7	0.4 (0.3%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-75. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-76. Simulated Monthly Average Salinity and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.6	0.0 (-0.3%)	0.6	0.0 (-0.6%)	0.5	0.0 (-0.4%)	0.6	0.0 (-0.8%)
November	0.5	0.0 (-0.1%)	0.6	0.0 (-0.3%)	0.5	0.0 (-0.4%)	0.6	0.0 (-0.7%)
December	0.6	0.0 (0.6%)	0.7	0.0 (0.5%)	0.6	0.0 (0.3%)	0.7	0.0 (0.2%)
January	0.7	0.0 (-0.2%)	0.8	0.0 (-0.5%)	0.6	0.0 (0.0%)	0.7	0.0 (0.2%)
February	0.6	0.0 (0.1%)	0.7	0.0 (0.1%)	0.6	0.0 (0.1%)	0.7	0.0 (0.3%)
March	0.6	0.0 (-0.4%)	0.7	0.0 (-0.2%)	0.5	0.0 (0.2%)	0.7	0.0 (0.5%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.1%)	0.4	0.0 (0.2%)	0.6	0.0 (0.3%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.4	0.0 (0.0%)	0.5	0.0 (0.1%)	0.4	0.0 (0.0%)	0.4	0.0 (0.3%)
July	0.4	0.0 (0.3%)	0.5	0.0 (0.6%)	0.4	0.0 (0.3%)	0.5	0.0 (0.6%)
August	0.5	0.0 (0.3%)	0.6	0.0 (0.6%)	0.5	0.0 (0.4%)	0.6	0.0 (1.0%)
September	0.6	0.0 (0.1%)	0.7	0.0 (0.3%)	0.6	0.0 (0.0%)	0.7	0.0 (0.2%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-77. Simulated Number of Months of Exceedence of the Salinity Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19f (CP2): Delta Water Quality in the West Canal at the Mouth of the Clifton Court Forebay Impact WQ-19f (CP2) would be similar to Impact WQ-19f (CP1). The 250-mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under CP2. CP2 would also not exceed EC thresholds. This impact would be less than significant.

Table 7-78 shows that maximum chloride concentrations under both existing and future project conditions are lower for CP2 than the 250 mg/L threshold. Maximum changes under both existing and future projection conditions are less than 1.5 percent. As shown in Table 7-79, CP2 the maximum change in EC values under existing and future project conditions would be less than 1.5 percent.

Table 7-78. Simulated Monthly Average Chlorides and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP2 Change (mg/L (%))	Existing Condition (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))	No-Action Alternative (mg/L)	CP2 Change (mg/L (%))
October	110.8	-0.5 (-0.5%)	124.3	-1.1 (-0.9%)	110.4	-0.6 (-0.6%)	125.1	-1.2 (-1.0%)
November	107.2	0.1 (0.1%)	123.4	-0.5 (-0.4%)	105.7	-0.2 (-0.2%)	124.8	-1.0 (-0.8%)
December	109.2	1.6 (1.5%)	131.8	1.2 (0.9%)	107.0	0.7 (0.6%)	131.1	0.3 (0.3%)
January	128.1	0.0 (0.0%)	154.3	-0.4 (-0.3%)	120.5	0.0 (0.0%)	145.3	0.0 (0.0%)
February	107.5	0.1 (0.1%)	134.7	0.5 (0.4%)	99.2	0.4 (0.4%)	124.2	1.6 (1.3%)
March	91.9	-0.3 (-0.3%)	132.1	0.4 (0.3%)	83.6	0.7 (0.8%)	122.4	1.7 (1.4%)
April	75.6	0.0 (0.0%)	110.3	0.2 (0.2%)	60.8	0.3 (0.6%)	96.4	0.9 (1.0%)
May	70.8	0.0 (0.0%)	99.9	0.0 (0.0%)	61.6	0.0 (0.1%)	91.6	0.1 (0.1%)
June	56.4	0.0 (-0.1%)	73.4	0.1 (0.1%)	51.8	0.0 (0.0%)	68.6	0.2 (0.4%)
July	52.2	0.3 (0.6%)	82.6	0.8 (1.0%)	51.3	0.3 (0.6%)	82.3	0.8 (1.0%)
August	80.5	0.0 (0.0%)	128.2	0.2 (0.2%)	80.4	0.5 (0.6%)	127.5	1.7 (1.3%)
September	115.0	0.1 (0.1%)	157.5	0.4 (0.3%)	114.9	0.0 (0.0%)	154.7	0.6 (0.4%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-79. Simulated Monthly Average Salinity and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.6	0.0 (-0.3%)	0.6	0.0 (-0.7%)	0.6	0.0 (-0.4%)	0.6	0.0 (-0.7%)
November	0.6	0.0 (0.1%)	0.6	0.0 (-0.3%)	0.5	0.0 (-0.1%)	0.6	0.0 (-0.6%)
December	0.6	0.0 (1.0%)	0.6	0.0 (0.7%)	0.6	0.0 (0.4%)	0.6	0.0 (0.2%)
January	0.6	0.0 (0.0%)	0.7	0.0 (-0.2%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
February	0.6	0.0 (0.1%)	0.7	0.0 (0.3%)	0.5	0.0 (0.3%)	0.6	0.0 (0.9%)
March	0.5	0.0 (-0.2%)	0.6	0.0 (0.2%)	0.5	0.0 (0.5%)	0.6	0.0 (1.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.1%)	0.4	0.0 (0.3%)	0.5	0.0 (0.7%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.1%)
June	0.4	0.0 (0.0%)	0.4	0.0 (0.1%)	0.4	0.0 (0.0%)	0.4	0.0 (0.2%)
July	0.4	0.0 (0.3%)	0.5	0.0 (0.6%)	0.3	0.0 (0.3%)	0.5	0.0 (0.7%)
August	0.5	0.0 (0.0%)	0.6	0.0 (0.1%)	0.5	0.0 (0.4%)	0.6	0.0 (1.0%)
September	0.6	0.0 (0.1%)	0.7	0.0 (0.2%)	0.6	0.0 (0.0%)	0.7	0.0 (0.3%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-80 shows the average number of days simulated chloride values exceeded the standards of 250 mg/L for the West Canal at the Clifton Court Forebay in a year. There would be no additional violations throughout the year under both existing and future project conditions. CP2 would not change the baseline compliance levels under both Existing and Future conditions.

As shown in Table 7-81, CP2 would not result in any additional violations of the salinity standards. CP2 would actually result in decreases in EC during several months of the year. CP2 would not change the baseline compliance levels under both Existing and Future conditions.

Overall, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-80. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-81. Simulated Number of Months of Exceedence of the Salinity Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)
November	0	1.0 (0.0%)	0	0.0 (0.0%)	3	-3.0 (-100.0%)	2	-2.0 (-100.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	2	-1.0 (-50.0%)	1	0.0 (0.0%)
January	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19g (CP2): Delta Salinity on the San Joaquin River at Vernalis

This impact would be similar to Impact WQ-19g (CP1). On an average monthly basis, EC would meet requirements in all months, in both average years and in dry and critical years. CP2 would not exceed EC thresholds on the San Joaquin River at Vernalis as shown in Tables 7-82 and 7-83. CP2 would not change the baseline compliance levels under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-82. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Vernalis Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-83. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Vernalis Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	3	0.0 (0.0%)	3	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19h (CP2): Delta Salinity on the San Joaquin River at Brandt Bridge Impact WQ-19h (CP2) would be similar to Impact WQ-19h (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-84. CP2 would not measurably change EC on the San Joaquin River at Brandt Bridge. This impact would be less than significant.

Table 7-85 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Brandt Bridge in the period of simulation. CP2 would not change the existing compliance level for salinity standards for the San Joaquin River at Brandt Bridge. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-84. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.1%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-85. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19i (CP2): Delta Salinity on the Old River near the Middle River
Impact WQ-19i (CP2) would be similar to Impact WQ-19i (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP2 would not measurably change EC on the Old River near the Middle River, as shown in Table 7-86. This impact would be less than significant.

Table 7-87 shows the number of months simulated EC values exceeded the standards for the Old River near the Middle River in the period of simulation. Compliance with salinity standards for the Old River near the Middle River would not change under CP2 when compared to the Existing Conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-86. Simulated Monthly Average Salinity and Percent Change for the Old River near Middle River Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-87. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River near Middle River Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19j (CP2): Delta Salinity on the Old River at Tracy Road Bridge

Impact WQ-19j (CP2) would be similar to Impact WQ-19j (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP2 would not measurably change EC on the Old River at Tracy Road Bridge, as shown in Table 7-88. This impact would be less than significant.

Table 7-89 shows the number of months simulated EC values exceeded the standards for the Old River near Tracy Road Bridge. Although exceedence would occur during August, under future conditions, on an annual average basis, the compliance of salinity standards under CP2 would not change from the Existing Conditions. Overall, CP2 would not change the baseline compliance levels under both Existing and Future conditions. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-88. Simulated Monthly Average Salinity and Percent Change for the Old River at Tracy Road Bridge Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	0.5	0.0 (0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.2%)	0.5	0.0 (0.1%)
November	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.1%)	0.5	0.0 (0.0%)	0.6	0.0 (0.1%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.1%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (-0.1%)	0.6	0.0 (-0.3%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.1%)	0.6	0.0 (0.1%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-89. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Tracy Road Bridge Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP2 Change	Existing Condition	CP2 Change	No-Action Alternative	CP2 Change	No-Action Alternative	CP2 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	7	0.0 (0.0%)	7	0.0 (0.0%)	5	0.0 (0.0%)	5	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	4	0.0 (0.0%)	4	0.0 (0.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-20 (CP2): X2 Position CP2 would not change average monthly X2 in either average years or in dry and critical years by more than 0.1 km under either the Existing Condition or Future Condition. Although several months may be out of compliance individually under the bases of comparison, the impact would be less than significant.

Impact WQ-20 (CP2) would be similar to Impact WQ-20 (CP1). Table 7-90 shows the simulated monthly average X2 position for CP2 as compared to the Existing Condition and Future Condition baselines. CalSim-II calculates the X2 position on a 1-month delay; the values shown have been corrected to accurately reflect the X2 position for the specified month.

This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-90. Simulated Monthly Average X2 Position Under Baseline Conditions and CP2

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (km)	CP2 Change (km (%))	Existing Condition (km)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP2 Change (mmhos/cm (%))
October	83.9	0.0 (-0.1%)	86.6	-0.1 (-0.1%)	83.9	-0.1 (-0.1%)	86.5	-0.1 (-0.1%)
November	82.2	0.1 (0.1%)	86.5	0.0 (0.0%)	82.2	0.1 (0.1%)	86.6	0.0 (0.0%)
December	76.1	0.0 (0.1%)	84.8	-0.1 (-0.1%)	76.0	0.1 (0.1%)	84.7	0.0 (0.0%)
January	67.5	0.0 (0.0%)	79.6	0.1 (0.1%)	67.3	0.0 (0.0%)	79.2	0.0 (0.1%)
February	60.9	0.1 (0.1%)	72.5	0.1 (0.2%)	60.8	0.0 (0.0%)	72.3	0.0 (0.1%)
March	60.9	0.0 (0.1%)	70.3	0.0 (0.0%)	60.9	0.0 (0.0%)	70.3	0.0 (0.0%)
April	63.5	0.0 (0.0%)	72.9	0.0 (0.0%)	63.4	0.0 (0.0%)	73.0	-0.1 (-0.1%)
May	67.5	0.0 (0.0%)	77.6	0.0 (0.0%)	67.7	0.0 (0.0%)	78.0	-0.1 (-0.1%)
June	74.5	0.0 (0.1%)	82.6	0.0 (0.0%)	74.7	0.0 (0.0%)	82.8	0.0 (0.0%)
July	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)
August	85.6	0.0 (0.0%)	88.8	-0.1 (-0.1%)	85.6	0.0 (0.0%)	88.6	-0.1 (-0.1%)
September	82.6	0.0 (0.0%)	91.1	-0.1 (-0.1%)	82.6	-0.1 (-0.1%)	90.9	-0.2 (-0.2%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node X2_PRV)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
km = kilometer
X2 = geographic location of 2 parts per thousand near-bottom salinity isohaline in the Delta, measured in distance upstream from Golden Gate Bridge in Suisun Bay.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

CP3 focuses on increasing agricultural water supply reliability while also increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 18.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Because CP3 focuses on increasing agricultural water supply reliability, none of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, with the additional storage retained for water supply reliability and to expand the cold-water pool for downstream anadromous fisheries.

Simulations of CP3 did not involve any changes to the modeling logic for deliveries or flow requirements; all rules for water operations were updated to include the new storage, but were not otherwise changed.

Shasta Lake and Vicinity

Impact WQ-1 (CP3): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-1 (CP1). However, the construction-related activities described in Chapter 2, "Alternatives," would result in about 1,270 more acres of exposed shoreline than CP1. Relocation activities under CP3 would expose a similar but greater acreage to erosion than would CP2 (up to 3,337 acres). This impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-2 (CP3): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses Similar to CP1, construction activities associated with enlarging Shasta Dam as well as the relocation actions would result in sizeable areas that would be subject to surface disturbance, including jurisdictional waters within the influence zone of CP3. Efforts to document jurisdictional waters associated with relocation areas are ongoing. This information will be included, if available, in the Final EIS, as well as in the Section 404 permitting package, before issuance of a ROD.

Environmental commitments and BMPs for the various construction and relocation activities (e.g., bridge replacement, boat ramp construction, demolition of facilities) have been incorporated into CP3. These activities could include removal of riparian vegetation, thereby exposing water bodies to increased solar radiation for various time periods. A riparian revegetation program will be implemented at all construction and relocation sites as applicable to ensure that shade is quickly reestablished after construction is completed.

As described in Chapter 2, “Alternatives,” although the TCD may not be operational for some period of time during construction, project sequencing will ensure that changes to water temperature and associated limnological conditions will be consistent with those that occur periodically under the No-Action Alternative associated with maintenance and outage periods.

Because of the large water surface area of Shasta Lake, coupled with the isolated and discrete nature of the relocation activities on the tributaries, temporary construction-related effects are not expected to modify water temperature in a manner that would have a negative effect on beneficial uses or result in a water quality violation. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-3 (CP3): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-3 (CP1). No construction activities would disturb locations known to contain elevated metal concentrations in either sediments or the water column. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-4 (CP3): Long-Term Sediment Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact is similar to WQ4 (CP1), except that the exposure of about 2,498 acres of shoreline surrounding Shasta Lake would result in a potential for increased wave-related shoreline erosion compared to the No-Action Alternative (see Attachment 17 of the Modeling Appendix). Therefore, this impact is potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-5 (CP3): Long-Term Temperature Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to CP1, this alternative would increase storage on a monthly basis, although it would vary by water year. This impact would be less than significant.

Table 7-91 illustrates the monthly change in simulated storage for CP3 as a percent increase above the No-Action Alternative. On average, CP3 represents an approximately 14-percent increase in the end-of-month storage on an annual basis.

Table 7-91. Simulated Average Increased End-of-Month Shasta Lake Storage – CP3

Month	Existing Conditions (TAF)	CP3 (TAF)	CP3 % Increase
October	2,592	399	15.4%
November	2,568	390	15.2%
December	2,722	424	15.6%
January	2,995	440	14.7%
February	3,267	457	14.0%
March	3,625	468	12.9%
April	3,916	459	11.7%
May	3,941	459	11.7%
June	3,639	455	12.5%
July	3,160	442	14.0%
August	2,834	431	15.2%
September	2,669	420	15.7%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)

Note:
Simulation period: 1922-2003

Key:
TAF = thousand acre-feet

Under CP3 existing water temperature requirements would typically be met in most years; therefore, the additional increase in water storage shown in Table 7-91 would primarily be released for water supply purposes. Accordingly, minimal increases in releases from Shasta Dam would be expected in months when Delta exports are constrained, or when flow is not usable for water supply purposes.

Similar to CP1, the increase in storage provided by CP3 fluctuates greatly throughout a year. A key indicator of water temperature benefits of CP3 to the upper Sacramento River between Keswick Dam and Red Bluff is the amount of cold water available in Shasta Lake before the water temperature operation season, about May through October. Similar to CP1, the CWP volume in the lake accumulates during winter and early spring and is not likely to increase after April. Therefore, the expected increase in spring storage for CP3 should also result in an incremental increase in the CWP volume.

The simulated end-of-April volume of water with a temperature lower than 52°F for the No-Action Alternative and the change in CWP volume for CP3 is shown, by SVI, in Table 7-92.

Table 7-92. Simulated Average Volume of Water Less than 52°F in Shasta Lake at the End of April – CP3

SVI Year Type	Existing Conditions (TAF)	CP3 (TAF)	% Increase
Average of All Years	2,609	385	15%
Wet	2,804	500	18%
Above Normal	2,972	432	15%
Below Normal	2,699	382	14%
Dry	2,542	322	13%
Critical	1,601	151	9%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations

Note:
Simulation period: 1922-2003
Year types as defined by the Sacramento Valley Index

Key:
SVI = Sacramento Valley Index
TAF = thousand acre-feet

In addition to illustrating the average change in available CWP, Table 7-92 also shows the influence of climatic conditions on these values. The diversity between water year types, coupled with unique combinations of storage and rainfall, would continue to influence the ability to manage storage in Shasta Lake to maximize carryover capacity. Although an increase in active storage and carryover storage of the CWP would occur, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-6 (CP3): Long-Term Metals Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to CP1, the increase in storage associated with this alternative would not result in modifying the depth and thickness of the thermocline that persists in Shasta Lake. This impact would be potentially significant.

Within the Squaw Creek Arm, two depositional features associated with historic copper mining and smelting operations are immediately adjacent to the shoreline of Shasta Lake in the general vicinity of the Bully Hill Mine. As mapped, these two sites appear to have about 7,300 cubic yards of material that could be subjected to shoreline and surficial erosional processes with an increase in reservoir elevations resultant related to CP3.

The impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (CP3): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality

Standards or Adversely Affect Beneficial Uses Construction would include ground-disturbing activities that could result in soil erosion and sediment effects on the upper Sacramento River. This impact would be potentially significant.

This impact would be the same as Impact WQ-7 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-8 (CP3): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in temperature effects on the upper Sacramento River because changes to water temperature in Shasta Lake and subsequent releases to the Sacramento River would be consistent with typical periodic fluctuations. This impact would be less than significant.

This impact would be identical to Impact WQ-8 (CP1). For the same reasons as described for Impact WQ-8 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-9 (CP3): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in water quality effects on the upper Sacramento River related to metals because construction would not disturb locations of known elevated metal concentrations. This impact would be less than significant.

This impact would be identical to Impact WQ-9 (CP1). For the same reasons as described for Impact WQ-9 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-10 (CP3): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River No long-term water quality impacts are anticipated in the upper Sacramento River in regard to sediment, because modeling results have indicated that CP3 would cause little change in average mean monthly flow, and could cause a decrease in peak flows that are associated with increased sediment transport. This impact would be less than significant.

This impact would be similar to Impact WQ-10 (CP1) because the extent of the effect of CP3 on sediment would be similar to that for CP1. For the same reasons as described for Impact WQ-10 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-11 (CP3): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Analysis of temperature modeling results indicates that CP3 would improve compliance with the temperature requirements on the Sacramento River because of the increased depth of the cold-water pool in Shasta Lake and the associated enhanced ability to regulate water temperature releases to the upper Sacramento River. Therefore, the impact on water quality measured as temperature would be beneficial.

CP3 would increase the ability of Shasta Dam to release cold water and regulate water temperature in the upper Sacramento River, primarily in dry and critical years. Raising Shasta Dam 18.5 feet would increase the cold-water pool and benefit seasonal water temperatures along the upper Sacramento River. This section focuses on compliance with water quality standards for temperature. For an analysis of temperature effects on fisheries and aquatic habitat, see Chapter 11, "Fisheries and Aquatic Resources."

Analysis of temperature modeling results indicates that CP3 would have a beneficial effect on temperature within the upper Sacramento River, with a slight decrease in average monthly water temperature during summer under both existing and future conditions. Decreased temperatures would improve compliance with the temperature objectives for the upper Sacramento River in the 2009 NMFS BO. CP3 would reduce temperature exceedences at Balls Ferry by 18 percent under existing conditions and 24 percent under future conditions. At the Bend Bridge compliance station, CP3 would reduce temperature exceedences by 8 percent under existing conditions and 11 percent under future conditions. Table 7-38 summarizes the temperature modeling results.

The impact on water quality measured as temperature would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-12 (CP3): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Long-term operation of the project could result in water quality effects on the upper Sacramento River in regard to metals as a result of erosional processes to historic mining and smelting operation features. This impact would be potentially significant.

This impact would be similar to Impact WQ-12 (CP3) because the extent of the effect of CP3 on metals would be similar to that for CP1. For the same reasons as described for Impact WQ-12 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact WQ-13 (CP3): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction is not anticipated to affect water quality conditions in the extended study area. This impact would be less than significant.

This impact would be similar to Impact WQ-13 (CP1). For the same reasons described for Impact WQ-13 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-14 (CP3): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-14 (CP1). For the same reasons described for Impact WQ-14 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-15 (CP3): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-15 (CP1). For the same reasons described for Impact WQ-15 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-16 (CP3): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Project implementation could affect water quality in the extended study area, but effects would diminish with distance. This impact would be less than significant.

This impact would be similar to Impact WQ-16 (CP1). For the same reasons as described for Impact WQ-16 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-17 (CP3): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-17 (CP1). Analysis of temperature modeling shows little to no change in temperature at RBPP caused by CP3. This suggests that no changes in temperature would occur beyond RBPP. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-18 (CP3): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-18 (CP1). For the same reasons as described for Impact WQ-18 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-19a (CP3): Delta Salinity on the Sacramento River at Collinsville Similar to WQ-19a (CP1) and WQ-19a (CP2), and as shown in Table 7-93, operations for CP3 would result in both increases and decreases in salinity; however, none of the increases would be sufficient to change compliance for the

Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 5 percent. The impact would be less than significant.

Table 7-94 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Collinsville in the period of simulation. The operation of CP3 would not result in any violation of the salinity standards under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-93. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Collinsville Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	6.0	0.0 (-0.3%)	7.1	0.0 (0.1%)	6.0	0.0 (-0.4%)	7.1	0.0 (-0.4%)
November	5.1	0.0 (0.4%)	6.8	0.0 (-0.2%)	5.1	0.0 (0.3%)	6.9	0.0 (-0.4%)
December	3.6	0.0 (0.0%)	5.5	0.0 (-0.3%)	3.6	0.0 (-1.3%)	5.5	-0.1 (-2.1%)
January	1.8	0.0 (0.6%)	3.4	0.0 (1.3%)	1.7	0.0 (-0.6%)	3.3	0.0 (-0.3%)
February	0.8	0.0 (0.7%)	1.7	0.0 (1.6%)	0.8	0.0 (1.4%)	1.6	0.0 (2.3%)
March	0.6	0.0 (0.1%)	1.2	0.0 (0.1%)	0.6	0.0 (0.6%)	1.1	0.0 (0.6%)
April	0.7	0.0 (-0.9%)	1.4	0.0 (-1.1%)	0.7	0.0 (-1.2%)	1.5	0.0 (-1.6%)
May	1.1	0.0 (-0.9%)	2.3	0.0 (-0.8%)	1.1	0.0 (-1.8%)	2.4	0.0 (-2.0%)
June	2.2	0.0 (-0.4%)	4.0	0.0 (-0.6%)	2.2	0.0 (-0.4%)	4.1	0.0 (-0.8%)
July	3.2	0.0 (-0.2%)	5.3	0.0 (-0.4%)	3.2	0.0 (-0.2%)	5.5	0.0 (-0.6%)
August	5.3	0.0 (0.1%)	7.3	0.0 (0.1%)	5.4	0.0 (-0.2%)	7.4	0.0 (-0.4%)
September	5.2	0.0 (0.1%)	8.8	0.0 (0.2%)	5.2	0.0 (-0.5%)	8.8	-0.1 (-0.6%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-94. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Collinsville Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP3 Change (Number of months (%))	Existing Condition (Number of months)	CP3 Change (Number of months (%))	No-Action Alternative (Number of months)	CP3 Change (Number of months (%))	No-Action Alternative (Number of months)	CP3 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19b (CP3): Delta Salinity on the San Joaquin River at Jersey Point
Impact WQ-19b (CP3) would be similar to Impact WQ-19b (CP1). Operations for CP3 would result in both increases and decreases in salinity in comparison with baseline conditions; however, none of the increases would be sufficient to change compliance for the San Joaquin River at Jersey Point. On a percentage basis, all increases in salinity would be less than 5 percent. The impact would be less than significant.

As shown in Table 7-95, the basis of comparison would meet the requirement on an average basis in both average years and in dry and critical years. Furthermore, all changes during April through August would be less than 1 percent.

Table 7-96 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Jersey Point in the period of simulation. No exceedences were shown, and CP3 would actually result in a decrease in the frequency of violations under Existing Conditions during July; by 2 percent in all years and 4.5 percent during dry and critical years.

Overall, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-95. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Jersey Point Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	1.6	0.0 (0.4%)	1.8	0.0 (0.7%)	1.6	0.0 (0.4%)	1.9	0.0 (0.0%)
November	1.5	0.0 (1.7%)	1.8	0.0 (1.4%)	1.5	0.0 (2.1%)	1.8	0.0 (1.7%)
December	1.2	0.0 (0.9%)	1.8	0.0 (0.2%)	1.2	0.0 (-1.2%)	1.7	-0.1 (-3.4%)
January	0.7	0.0 (1.7%)	1.1	0.0 (3.2%)	0.7	0.0 (-0.5%)	1.0	0.0 (-0.4%)
February	0.3	0.0 (2.2%)	0.5	0.0 (4.4%)	0.3	0.0 (2.6%)	0.5	0.0 (5.2%)
March	0.3	0.0 (0.3%)	0.3	0.0 (1.1%)	0.3	0.0 (0.8%)	0.3	0.0 (1.8%)
April	0.3	0.0 (-0.2%)	0.3	0.0 (-0.1%)	0.3	0.0 (-0.1%)	0.3	0.0 (-0.3%)
May	0.3	0.0 (-0.2%)	0.4	0.0 (-0.2%)	0.3	0.0 (-0.8%)	0.4	0.0 (-1.6%)
June	0.4	0.0 (-0.3%)	0.7	0.0 (-0.4%)	0.4	0.0 (-0.6%)	0.7	0.0 (-1.0%)
July	1.0	0.0 (-0.3%)	1.7	0.0 (-0.6%)	1.0	0.0 (0.2%)	1.7	0.0 (0.1%)
August	1.6	0.0 (0.1%)	2.2	0.0 (0.1%)	1.6	0.0 (0.6%)	2.1	0.0 (1.1%)
September	1.9	0.0 (0.5%)	2.8	0.0 (0.3%)	1.9	0.0 (0.5%)	2.8	0.0 (0.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-96. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Jersey Point Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	10	0.0 (0.0%)	8	0.0 (0.0%)	13	0.0 (0.0%)	11	0.0 (0.0%)
July	51	-1.0 (-2.0%)	22	-1.0 (-4.5%)	50	0.0 (0.0%)	21	0.0 (0.0%)
August	73	0.0 (0.0%)	25	0.0 (0.0%)	76	0.0 (0.0%)	27	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19c (CP3): Delta Salinity on the Sacramento River at Emmaton

On an average monthly basis, EC would meet the requirements in all months on an average annual basis; moreover, CP3 would not increase the EC at Emmaton during this period by more than 2.8 percent. This impact would be less than significant.

Impact WQ-19c (CP3) would be similar to Impact WQ-19c (CP1). Although Table 7-97 shows EC for all months, the Emmaton water quality requirement is only defined for April 1 through August 15. On an average monthly basis, EC would meet the requirements in all months on an average annual basis. Table 7-98 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Emmaton in the period of simulation. CP3 would result in an increase in the frequency of violations under Existing and Future Conditions during May, by up to 33.3 percent in all years and dry and critical years. However, CP3 would result in a decrease in the frequency of violations under Existing and Future Conditions during April, June and August, by up to 50 percent in the average of all years and dry and critical years. Overall, the compliance of salinity standards for the Sacramento River at Emmaton would be very similar to the baseline levels under both Existing and Future conditions.

The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-97. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Emmaton Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	2.0	0.0 (-0.8%)	2.4	0.0 (-0.1%)	2.0	0.0 (-1.1%)	2.5	0.0 (-0.8%)
November	1.5	0.0 (0.1%)	2.2	0.0 (-0.7%)	1.5	0.0 (-0.5%)	2.3	0.0 (-1.3%)
December	1.0	0.0 (-0.8%)	1.5	0.0 (-1.3%)	0.9	0.0 (-2.3%)	1.5	0.0 (-3.2%)
January	0.5	0.0 (0.8%)	0.7	0.0 (1.7%)	0.4	0.0 (-0.1%)	0.7	0.0 (0.3%)
February	0.3	0.0 (1.0%)	0.4	0.0 (2.3%)	0.3	0.0 (1.3%)	0.4	0.0 (2.8%)
March	0.2	0.0 (0.3%)	0.3	0.0 (0.6%)	0.2	0.0 (0.6%)	0.3	0.0 (1.2%)
April	0.3	0.0 (-0.5%)	0.3	0.0 (-0.7%)	0.3	0.0 (-0.7%)	0.4	0.0 (-1.3%)
May	0.3	0.0 (-0.4%)	0.5	0.0 (-0.5%)	0.3	0.0 (-1.3%)	0.6	0.0 (-1.9%)
June	0.6	0.0 (-0.4%)	1.1	0.0 (-0.6%)	0.6	0.0 (-0.6%)	1.1	0.0 (-0.9%)
July	0.7	0.0 (-0.3%)	1.3	0.0 (-0.5%)	0.8	0.0 (-0.7%)	1.4	0.0 (-1.3%)
August	1.4	0.0 (0.2%)	2.3	0.0 (0.1%)	1.5	0.0 (-0.7%)	2.3	0.0 (-1.2%)
September	1.6	0.0 (0.2%)	3.0	0.0 (0.4%)	1.6	0.0 (-1.0%)	3.1	0.0 (-1.1%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-98. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Emmaton Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	1	0.0 (0.0%)	1	0.0 (0.0%)	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
June	28	-1.0 (-3.6%)	18	0.0 (0.0%)	27	0.0 (0.0%)	19	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	69	-1.0 (-1.4%)	26	-1.0 (-3.8%)	70	-1.0 (-1.4%)	26	-1.0 (-3.8%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19d (CP3): Delta Salinity on the Old River at Rock Slough Impact WQ-19d (CP3) would be similar to Impact WQ-19d (CP1). On an average annual basis, chloride levels under both the Existing Condition and Future Condition would be less than 150 mg/L from February through July. This impact would be less than significant.

Table 7-99 shows that in average annual years, CP3 would not increase chlorides by more than 1.2 percent. For dry and critical years, a maximum change of 2.5 percent in chloride concentration would occur. Change in chloride concentration would not affect compliance with the standard; it would already be exceeded under the basis of comparison. This impact would be less than significant.

Table 7-100 shows the number of days in a year when simulated chloride values exceeded the standards of 150 mg/L for the Old River at Rock Slough. No daily violations of the chloride standards would occur under both existing and future conditions under CP3. Overall, CP3 would not alter the compliance level observed under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-99. Simulated Monthly Average Chlorides and Percent Change for the Old River at Rock Slough Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP3 Change (mg/L (%))	Existing Condition (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))
October	156.2	0.4 (0.3%)	175.6	0.8 (0.4%)	157.1	0.1 (0.1%)	176.7	-0.1 (0.0%)
November	154.9	0.4 (0.2%)	177.7	1.0 (0.6%)	155.3	0.6 (0.4%)	181.1	-0.2 (-0.1%)
December	144.3	1.8 (1.2%)	178.3	1.6 (0.9%)	151.7	1.1 (0.8%)	186.7	1.6 (0.9%)
January	153.9	1.3 (0.9%)	183.5	2.9 (1.6%)	164.9	-0.9 (-0.6%)	197.1	-3.1 (-1.6%)
February	106.2	0.5 (0.5%)	112.3	2.8 (2.5%)	119.2	0.2 (0.2%)	115.5	0.8 (0.7%)
March	95.2	-0.6 (-0.6%)	92.3	1.5 (1.6%)	103.8	0.4 (0.4%)	95.6	1.0 (1.0%)
April	88.4	-0.3 (-0.3%)	86.6	0.5 (0.6%)	90.0	0.2 (0.2%)	85.4	0.4 (0.4%)
May	90.4	-0.1 (-0.2%)	92.3	0.2 (0.2%)	87.5	0.2 (0.2%)	87.2	0.4 (0.5%)
June	62.4	0.0 (-0.1%)	75.8	0.0 (0.0%)	61.5	-0.2 (-0.3%)	75.4	-0.4 (-0.5%)
July	73.8	-0.1 (-0.2%)	111.3	-0.5 (-0.4%)	76.6	0.1 (0.1%)	115.5	-0.1 (-0.1%)
August	117.0	-0.2 (-0.1%)	182.4	-0.7 (-0.4%)	122.0	0.2 (0.2%)	186.3	0.4 (0.2%)
September	158.5	0.6 (0.4%)	210.3	0.6 (0.3%)	167.1	0.9 (0.5%)	208.4	1.2 (0.6%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006) converted to chlorides using the equation EC*0.268-24*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-100. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Old River at Rock Slough Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of days)	CP3 Change (Number of days (%))	Existing Condition (Number of days)	CP3 Change (Number of days (%))	No-Action Alternative (Number of days)	CP3 Change (Number of days (%))	No-Action Alternative (Number of days)	CP3 Change (Number of days (%))
October	17	0 (0%)	7	0 (0%)	17	0 (0%)	7	0 (0%)
November	16	0 (0%)	7	0 (0%)	16	0 (0%)	7	0 (0%)
December	14	0 (0%)	7	0 (0%)	15	0 (0%)	7	0 (0%)
January	13	0 (0%)	7	0 (0%)	16	0 (0%)	8	0 (0%)
February	5	0 (0%)	2	0 (0%)	7	0 (0%)	2	0 (0%)
March	3	0 (0%)	1	0 (0%)	5	0 (0%)	0	0 (0%)
April	1	0 (0%)	0	0 (0%)	1	0 (0%)	0	0 (0%)
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	3	0 (0%)	3	0 (0%)	3	0 (0%)	3	0 (0%)
August	10	0 (0%)	10	0 (0%)	11	0 (0%)	10	0 (0%)
September	18	0 (0%)	11	0 (0%)	20	0 (0%)	11	0 (0%)
Total	99	0 (0%)	54	0 (0%)	111	0 (0%)	56	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Impact WQ-19e (CP3): Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant This impact would be similar to Impact WQ-19e (CP1). The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. Tables 7-101 and 7-102 show that CP3 would not cause exceedence of chloride thresholds. All increases in chloride concentrations would be less than 5 percent. Chloride values under CP3 would be similar to the baseline values under both Existing and Future conditions. Tables 7-103 and 7-104 show that increases in EC would be less 5 percent under CP3 and would not exceed the EC threshold. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-101. Simulated Monthly Average Chlorides and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP3 Change (mg/L (%))	Existing Condition (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))
October	107.1	0.2 (0.2%)	117.9	0.1 (0.1%)	105.1	-0.1 (-0.1%)	117.0	-0.7 (-0.6%)
November	105.8	-0.1 (-0.1%)	118.9	0.1 (0.1%)	103.1	0.0 (0.0%)	118.4	-0.8 (-0.7%)
December	124.1	1.0 (0.8%)	142.3	1.1 (0.8%)	118.1	0.2 (0.2%)	136.7	-0.8 (-0.6%)
January	141.4	0.4 (0.3%)	165.9	1.0 (0.6%)	129.5	-0.9 (-0.7%)	151.2	-2.3 (-1.5%)
February	123.6	0.1 (0.1%)	159.4	1.2 (0.7%)	113.7	-0.3 (-0.2%)	148.2	-0.3 (-0.2%)
March	106.9	-0.2 (-0.2%)	157.9	0.5 (0.3%)	97.1	0.1 (0.1%)	146.9	0.2 (0.2%)
April	84.0	0.1 (0.1%)	123.4	0.3 (0.3%)	68.6	0.1 (0.2%)	108.4	0.3 (0.3%)
May	75.3	0.0 (0.0%)	106.4	0.1 (0.1%)	66.0	0.1 (0.1%)	97.7	0.2 (0.2%)
June	66.4	0.0 (-0.1%)	81.4	0.1 (0.1%)	60.8	0.1 (0.1%)	75.6	0.3 (0.4%)
July	60.8	0.0 (0.0%)	83.1	-0.1 (-0.1%)	58.8	0.1 (0.1%)	82.1	0.0 (0.0%)
August	82.2	0.0 (0.0%)	121.9	-0.3 (-0.2%)	80.6	0.2 (0.2%)	121.2	0.3 (0.3%)
September	109.5	0.3 (0.3%)	145.0	0.6 (0.4%)	107.5	0.3 (0.3%)	141.7	0.7 (0.5%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-102. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-103. Simulated Monthly Average Salinity and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.5	0.0 (-0.1%)	0.6	0.0 (-0.4%)
November	0.5	0.0 (-0.1%)	0.6	0.0 (0.1%)	0.5	0.0 (0.0%)	0.6	0.0 (-0.5%)
December	0.6	0.0 (0.6%)	0.7	0.0 (0.6%)	0.6	0.0 (0.1%)	0.7	0.0 (-0.5%)
January	0.7	0.0 (0.2%)	0.8	0.0 (0.5%)	0.6	0.0 (-0.5%)	0.7	0.0 (-1.2%)
February	0.6	0.0 (0.1%)	0.7	0.0 (0.6%)	0.6	0.0 (-0.2%)	0.7	0.0 (-0.2%)
March	0.6	0.0 (-0.2%)	0.7	0.0 (0.3%)	0.5	0.0 (0.1%)	0.7	0.0 (0.1%)
April	0.5	0.0 (0.1%)	0.6	0.0 (0.2%)	0.4	0.0 (0.1%)	0.6	0.0 (0.2%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.1%)	0.4	0.0 (0.1%)	0.5	0.0 (0.1%)
June	0.4	0.0 (0.0%)	0.5	0.0 (0.1%)	0.4	0.0 (0.1%)	0.4	0.0 (0.3%)
July	0.4	0.0 (0.0%)	0.5	0.0 (-0.1%)	0.4	0.0 (0.1%)	0.5	0.0 (0.0%)
August	0.5	0.0 (0.0%)	0.6	0.0 (-0.2%)	0.5	0.0 (0.1%)	0.6	0.0 (0.2%)
September	0.6	0.0 (0.2%)	0.7	0.0 (0.3%)	0.6	0.0 (0.2%)	0.7	0.0 (0.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-104. Simulated Number of Months of Exceedence of the Salinity Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19f (CP3): Delta Water Quality in the West Canal at the Mouth of the Clifton Court Forebay Impact WQ-19f (CP3) would be similar to Impact WQ-19f (CP1). The 250-mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under CP3. CP3 would also not exceed EC thresholds. This impact would be less than significant.

Table 7-105 shows that maximum chloride concentrations under both existing and future project conditions are lower for CP3 than the 250 mg/L threshold. Maximum changes under both existing and future projection conditions are less than 1.5 percent. As shown in Table 7-106, CP2 the maximum change in EC values under existing and future project conditions would be less than 1.5 percent.

Table 7-105. Simulated Monthly Average Chlorides and Percent Change for West Canal at Clifton Court Forebay Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP3 Change (mg/L (%))	Existing Condition (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))	No-Action Alternative (mg/L)	CP3 Change (mg/L (%))
October	110.8	0.3 (0.3%)	124.3	0.4 (0.3%)	110.4	0.0 (0.0%)	125.1	-0.4 (-0.4%)
November	107.2	0.2 (0.2%)	123.4	0.4 (0.3%)	105.7	0.5 (0.5%)	124.8	-0.4 (-0.3%)
December	109.2	1.5 (1.4%)	131.8	1.6 (1.2%)	107.0	0.3 (0.3%)	131.1	-1.4 (-1.1%)
January	128.1	0.7 (0.6%)	154.3	1.5 (0.9%)	120.5	-1.3 (-1.1%)	145.3	-3.6 (-2.5%)
February	107.5	-0.1 (-0.1%)	134.7	1.1 (0.8%)	99.2	-0.2 (-0.2%)	124.2	0.1 (0.1%)
March	91.9	-0.1 (-0.2%)	132.1	1.3 (1.0%)	83.6	0.3 (0.4%)	122.4	0.9 (0.7%)
April	75.6	0.1 (0.2%)	110.3	0.6 (0.5%)	60.8	0.2 (0.4%)	96.4	0.7 (0.7%)
May	70.8	0.1 (0.1%)	99.9	0.2 (0.2%)	61.6	0.2 (0.3%)	91.6	0.5 (0.5%)
June	56.4	0.0 (-0.1%)	73.4	0.1 (0.1%)	51.8	0.0 (0.0%)	68.6	0.2 (0.3%)
July	52.2	0.0 (0.0%)	82.6	-0.1 (-0.2%)	51.3	0.0 (0.1%)	82.3	0.0 (0.0%)
August	80.5	-0.1 (-0.1%)	128.2	-0.3 (-0.2%)	80.4	0.3 (0.4%)	127.5	0.7 (0.5%)
September	115.0	0.5 (0.4%)	157.5	0.7 (0.5%)	114.9	0.6 (0.5%)	154.7	1.0 (0.6%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-106. Simulated Monthly Average Salinity and Percent Change for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.6	0.0 (0.2%)	0.6	0.0 (0.2%)	0.6	0.0 (0.0%)	0.6	0.0 (-0.3%)
November	0.6	0.0 (0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.4%)	0.6	0.0 (-0.2%)
December	0.6	0.0 (1.0%)	0.6	0.0 (0.9%)	0.6	0.0 (0.2%)	0.6	0.0 (-0.8%)
January	0.6	0.0 (0.4%)	0.7	0.0 (0.7%)	0.6	0.0 (-0.8%)	0.7	0.0 (-1.9%)
February	0.6	0.0 (-0.1%)	0.7	0.0 (0.6%)	0.5	0.0 (-0.1%)	0.6	0.0 (0.0%)
March	0.5	0.0 (-0.1%)	0.6	0.0 (0.7%)	0.5	0.0 (0.2%)	0.6	0.0 (0.5%)
April	0.4	0.0 (0.1%)	0.6	0.0 (0.4%)	0.4	0.0 (0.2%)	0.5	0.0 (0.5%)
May	0.4	0.0 (0.1%)	0.5	0.0 (0.1%)	0.4	0.0 (0.2%)	0.5	0.0 (0.3%)
June	0.4	0.0 (0.0%)	0.4	0.0 (0.1%)	0.4	0.0 (0.0%)	0.4	0.0 (0.2%)
July	0.4	0.0 (0.0%)	0.5	0.0 (-0.1%)	0.3	0.0 (0.0%)	0.5	0.0 (0.0%)
August	0.5	0.0 (0.0%)	0.6	0.0 (-0.2%)	0.5	0.0 (0.2%)	0.6	0.0 (0.4%)
September	0.6	0.0 (0.3%)	0.7	0.0 (0.4%)	0.6	0.0 (0.3%)	0.7	0.0 (0.5%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-107 shows the average number of days simulated chloride values exceeded the standards of 250 mg/L for the West Canal at the Clifton Court Forebay in a year. There would be no additional violations throughout the year under both existing and future project conditions. CP3 would not change the baseline compliance levels under both Existing and Future conditions.

As shown in Table 7-108, CP3 would not result in any additional violations of the salinity standards. CP3 would actually result in decreases in EC during several months of the year. CP3 would not change the baseline compliance levels under both Existing and Future conditions.

Overall, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-107. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-108. Simulated Number of Months of Exceedence of the Salinity Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	3	-1.0 (-33.3%)	2	0.0 (0.0%)
December	0	1.0 (0.0%)	0	1.0 (0.0%)	2	-1.0 (-50.0%)	1	0.0 (0.0%)
January	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19g (CP3): Delta Salinity on the San Joaquin River at Vernalis

This impact would be similar to Impact WQ-19g (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP3 would not exceed EC thresholds on the San Joaquin River at Vernalis, as shown in Tables 7-109 and 7-110. CP3 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-109. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Vernalis Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-110. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Vernalis Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	3	0.0 (0.0%)	3	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19h (CP3): Delta Salinity on the San Joaquin River at Brandt Bridge This impact would be similar to Impact WQ-19h (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years, as shown in Table 7-111. CP3 would not measurably change EC on the San Joaquin River at Brandt Bridge. This impact would be less than significant.

Table 7-112 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Brandt Bridge in the period of simulation. CP3 would not change the Existing compliance level for salinity standards for the San Joaquin River at Brandt Bridge. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-111. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.1%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-112. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19i (CP3): Delta Salinity on the Old River near the Middle River

Impact WQ-19i (CP3) would be similar to Impact WQ-19i (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP3 would not measurably change EC on the Old River near the Middle River, as shown in Table 7-113. This impact would be less than significant.

Table 7-114 shows the number of months simulated EC values exceeded the standards for the Old River near the Middle River in the period of simulation. Compliance with salinity standards for the Old River near the Middle River would not change under CP3 when compared to the Existing Conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-113. Simulated Monthly Average Salinity and Percent Change for the Old River near the Middle River Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-114. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River near the Middle River Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP3 Change (Number of months (%))	Existing Condition (Number of months)	CP3 Change (Number of months (%))	No-Action Alternative (Number of months)	CP3 Change (Number of months (%))	No-Action Alternative (Number of months)	CP3 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19j (CP3): Delta Salinity on the Old River at Tracy Road Bridge

Impact WQ-19j (CP3) would be similar to Impact WQ-19j (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP3 would not measurably change EC on the Old River at Tracy Road Bridge, as shown in Table 7-115. This impact would be less than significant.

Table 7-116 shows the number of months simulated EC values exceeded the standards for the Old River near Tracy Road Bridge in the period of simulation. Although salinity level would be alternately exceeded and improved during several months, on an annual average basis, the compliance of salinity standards under CP2 would not change from the Existing Conditions. Overall, CP3 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-115. Simulated Monthly Average Salinity and Percent Change for the Old River at Tracy Road Bridge Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP3 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.6	0.0 (-0.1%)	0.5	0.0 (0.1%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.1%)	0.6	0.0 (0.0%)	0.6	0.0 (0.1%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.1%)	0.6	0.0 (0.1%)
July	0.6	0.0 (-0.1%)	0.7	0.0 (-0.3%)	0.6	0.0 (0.1%)	0.6	0.0 (0.2%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.1%)	0.6	0.0 (0.2%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.2%)	0.6	0.0 (0.4%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-116. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Tracy Road Bridge Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP3 Change	Existing Condition	CP3 Change	No-Action Alternative	CP3 Change	No-Action Alternative	CP3 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	7	0.0 (0.0%)	7	0.0 (0.0%)	5	0.0 (0.0%)	5	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	4	0.0 (0.0%)	4	0.0 (0.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-20 (CP3): X2 Position CP3 would not change average monthly X2 in either average years or in dry and critical years by more than 0.1 km under either the Existing Condition or Future Condition. Although several months may be out of compliance individually under the bases of comparison, the impact would be would be less than significant.

This impact would be similar to Impact WQ-20 (CP1). Table 7-117 shows the simulated monthly average X2 position for CP3 compared to the Existing Condition and Future Condition baselines. CalSim-II calculates the X2 position on a 1-month delay; the values shown have been corrected to accurately reflect the X2 position for the specified month. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-117. Simulated Monthly Average X2 Position Under Baseline Conditions and CP3

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (km)	CP3 Change (km (%))	Existing Condition (km)	CP3 Change (km (%))	No-Action Alternative (km)	CP3 Change (km (%))	No-Action Alternative (km)	CP3 Change (km (%))
October	83.9	0.0 (0.0%)	86.6	0.0 (0.0%)	83.9	0.0 (0.0%)	86.5	0.0 (0.0%)
November	82.2	0.1 (0.1%)	86.5	0.0 (0.0%)	82.2	0.1 (0.1%)	86.6	0.0 (0.0%)
December	76.1	0.1 (0.1%)	84.8	0.0 (0.0%)	76.0	0.0 (0.0%)	84.7	-0.2 (-0.3%)
January	67.5	0.0 (0.1%)	79.6	0.1 (0.1%)	67.3	0.0 (0.0%)	79.2	0.0 (-0.1%)
February	60.9	0.0 (0.0%)	72.5	0.1 (0.1%)	60.8	0.0 (0.1%)	72.3	0.1 (0.1%)
March	60.9	0.0 (0.0%)	70.3	0.0 (-0.1%)	60.9	0.0 (0.1%)	70.3	0.0 (0.0%)
April	63.5	0.0 (-0.1%)	72.9	-0.1 (-0.1%)	63.4	0.0 (-0.1%)	73.0	-0.1 (-0.1%)
May	67.5	0.0 (0.0%)	77.6	-0.1 (-0.1%)	67.7	-0.1 (-0.1%)	78.0	-0.2 (-0.2%)
June	74.5	0.0 (0.0%)	82.6	-0.1 (-0.1%)	74.7	0.0 (0.0%)	82.8	-0.1 (-0.1%)
July	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)
August	85.6	0.0 (0.0%)	88.8	0.0 (0.0%)	85.6	0.0 (0.0%)	88.6	0.0 (0.0%)
September	82.6	0.0 (0.0%)	91.1	0.0 (0.0%)	82.6	0.0 (0.0%)	90.9	0.0 (0.0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node X2_PRV)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
km = kilometer
X2 = geographic location of 2 parts per thousand near-bottom salinity isohaline in the Delta, measured in distance upstream from Golden Gate Bridge in Suisun Bay.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

CP4 focuses on increasing anadromous fish survival while also increasing water supply reliability. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP4 would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. The additional storage created by the 18.5-foot dam raise would be used to improve the ability to meet temperature objectives and habitat requirements for anadromous fish during drought years and increase water supply reliability. Of the increased reservoir storage space, about 378,000 acre-feet would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. Operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as in CP1, with 70 TAF and 35 TAF reserved to specifically focus on increasing M&I deliveries during dry and critical years, respectively. CP4 also includes augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River.

Shasta Lake and Vicinity

Impact WQ-1 (CP4): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-1 (CP3). The nature of inundation and relocation impacts is consistent with those described for CP3 in Chapter 2, "Alternatives." The impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-2 (CP4): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-2 (CP3). The nature of inundation and relocation impacts is consistent with those described for CP3 in Chapter 2, "Alternatives." The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-3 (CP4): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-3 (CP1). No construction activities would disturb locations known to contain elevated metal concentrations in either sediments or the water column. Therefore, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-4 (CP4): Long-Term Sediment Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact would be similar to Impact WQ-4 (CP3). The nature of inundation and relocation impacts is consistent with those described for CP3.

The impact would be a potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-5 (CP4): Long-Term Temperature Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to CP1, this alternative would increase storage on a monthly basis, although it would vary by water year. Table 7-118 illustrates the monthly change in simulated storage for CP4 as a percent increase above the No-Action Alternative. On average, CP4 represents an approximately 17-percent increase in the end-of-month storage on an annual basis.

Under CP4, existing water temperature requirements would typically be met in most years; therefore, the additional increase in water storage shown in Table 7-118 would primarily be released for water supply purposes. Accordingly, minimal increases in releases from Shasta Dam would be expected in months when Delta exports are constrained, or when flow is not usable for water supply purposes.

Table 7-118. Simulated Average Increased End-of-Month Shasta Lake Storage – CP4

Month	Existing Conditions (TAF)	CP4 (TAF)	CP4 % Increase
October	2,587	526	20.3%
November	2,573	520	20.2%
December	2,735	539	19.7%
January	3,010	545	18.1%
February	3,279	556	17.0%
March	3,636	560	15.4%
April	3,934	555	14.1%
May	3,961	557	14.1%
June	3,653	556	15.2%
July	3,167	548	17.3%
August	2,841	544	19.1%
September	2,662	535	20.1%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)

Note:
Simulation period: 1922-2003

Key:
TAF = thousand acre-feet

Similar to CP1, the increase in storage provided by CP4 fluctuates greatly throughout a year. A key indicator of water temperature benefits of CP3 to the upper Sacramento River between Keswick Dam and Red Bluff is the amount of cold water available in Shasta Lake before the water temperature operation season, about May through October. Similar to CP1, the CWP volume in the lake accumulates during the winter and early spring and is not likely to increase after April. Therefore, the expected increase in spring storage for CP4 should also result in an incremental increase in the CWP volume.

The simulated end-of-April volume of water with a temperature lower than 52˚F for the No-Action Alternative and the change in CWP volume for CP4 is shown, by SVI, in Table 7-119.

Table 7-119. Simulated Average Volume of Water Less than 52˚F in Shasta Lake at the End of April – CP4

SVI Year Type	Existing Conditions (TAF)	CP4 (TAF)	% Increase
Average of All Years	2,609	470	18%
Wet	2,804	510	18%
Above Normal	2,972	502	17%
Below Normal	2,699	462	17%
Dry	2,542	441	17%
Critical	1,601	364	23%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations

Note:
Simulation period: 1922-2003
Year types as defined by the Sacramento Valley Index

Key:
SVI = Sacramento Valley Index
TAF = thousand acre-feet

In addition to illustrating the average change in available CWP, Table 7-119 also shows the influence of climatic conditions on these values. The diversity between water year types, coupled with unique combinations of storage and rainfall would continue to influence the ability to manage storage in Shasta Lake to maximize carryover capacity. Although a meaningful increase in active storage and carryover storage of the CWP would occur, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-6 (CP4): Long-Term Metals Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact is similar to CP1. The nature of inundation impacts is consistent with those described for CP3. The impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (CP4): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction would include ground-disturbing activities that could result in soil erosion and sediment effects on the upper Sacramento River. This impact would be potentially significant.

Ground-disturbing activities associated with construction could cause soil erosion and sedimentation of local drainages and eventually the Sacramento River. Construction activities could also discharge waste petroleum products or other construction-related substances that could enter these waterways/facilities in runoff. In addition, transportation, handling, and placement of materials used for gravel augmentation as well as clearing, grubbing, and grading during construction could also adversely affect water quality and temporarily increase turbidity and sedimentation downstream from the gravel augmentation sites. In-water construction work at some gravel augmentation sites could also result in temporary increase in turbidity, downstream sedimentation, and accidental discharge of construction-related substances into the river channel.

In addition, riparian, floodplain, and side channel habitat restoration as part of CP4 would involve breaching the levee using an excavator, loader, and compaction equipment and excavation of approximately 15,650 cubic yards of earthen material for off-site disposal, and potential vegetation clearing along 0.8 mile of channel. Invasive aquatic vegetation would be removed as well. Although in-water construction is expected to take place during periods of low flow in the Sacramento River (October to November) to minimize effects on water quality, construction activities related to habitat restoration and vegetation clearing could adversely affect water quality and temporarily increase turbidity and sedimentation downstream, or result in the accidental discharge of construction-related substances into the river channel. In addition, excavated sediments could be contaminated with pesticides and metals. Development and implementation of a SWPPP as part of the environmental commitments described in Chapter 2, "Alternatives," would reduce potential impacts related to pesticides and metals. However, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-8 (CP4): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in temperature effects on the upper Sacramento River because changes to water temperature in Shasta Lake and subsequent releases to the Sacramento River would be consistent with typical periodic fluctuations. This impact would be less than significant.

This impact would be similar to Impact WQ-8 (CP1). For the same reasons as described for Impact WQ-8 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-9 (CP4): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in water quality effects on the upper Sacramento River related to metals because construction would not disturb locations of known elevated metal concentrations. This impact would be less than significant.

This impact would be similar to Impact WQ-9 (CP1). For the same reasons as described for Impact WQ-9 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-10 (CP4): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River No long-term water quality impacts are anticipated in the upper Sacramento River in regard to sediment, because modeling results have indicated that CP4 would cause little change in average mean monthly flow, and could cause a decrease in peak flows that are associated with increased sediment transport. This impact would be less than significant.

This impact would be similar to Impact WQ-10 (CP1) because the extent of the effect of CP4 on sediment would be similar to that for CP1. For the same reasons as described for Impact WQ-10 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-11 (CP4): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Analysis of temperature modeling results indicates that CP4 would improve compliance with the temperature requirements on the Sacramento River because of the increased depth of the cold-water pool in Shasta Lake and the associated enhanced ability to regulate water temperature releases to the upper Sacramento River. Therefore, the impact on water quality measured as temperature would be beneficial.

CP4 would increase the ability of Shasta Dam to release cold water and regulate water temperature in the upper Sacramento River, primarily in dry and critical years. Raising Shasta Dam 18.5 feet would increase the cold-water pool and benefit seasonal water temperatures along the upper Sacramento River. This section focuses on compliance with water quality standards for temperature. For an analysis of temperature effects on fisheries and aquatic habitat, see Chapter 11, “Fisheries and Aquatic Resources.”

Analysis of temperature modeling results indicates that CP4 would have a beneficial effect on temperature within the upper Sacramento River with a measurable decrease in average monthly water temperature during summer months under both existing and future conditions. For instance, at the Balls Ferry compliance station in September, average monthly water temperature would be reduced by 1.2°F. During October at Balls Ferry, the average monthly temperature would decrease by 1.6°F. For more information on modeling results and monthly water temperature, see Chapter 11, “Fisheries and Aquatic Resources.”

Decreased temperatures would improve compliance with the temperature objectives for the upper Sacramento River in the 2009 NMFS BO. Analysis of modeling results indicates that CP4 would reduce temperature exceedences at Balls Ferry by 37 percent under existing conditions and 40 percent under future conditions. At the Bend Bridge compliance station, CP4 would reduce temperature exceedences by 13-percent under existing conditions and 15 percent under future conditions. Table 7-38 summarizes the temperature modeling results.

The impact would be beneficial; CP4 would have the greatest beneficial effect on water temperature of all alternatives evaluated. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-12 (CP4): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Long-term operation of the project could result in water quality effects on the upper Sacramento River in regard to metals as a result of erosional processes to historic mining and smelting operation features. This impact would be potentially significant.

This impact is similar to Impact WQ-12 (CP1) because the extent of the effect of CP4 on metals would be similar to that for CP1. For the same reasons as described for Impact WQ-12 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact WQ-13 (CP4): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction is not anticipated to affect water quality conditions in the extended study area. This impact would be less than significant.

This impact would be similar to Impact WQ-13 (CP1). For the same reasons as described for Impact WQ-13 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-14 (CP4): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-14 (CP1). For the same reasons as described for Impact WQ-14 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-15 (CP4): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-15 (CP1). For the same reasons as described for Impact WQ-15 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-16 (CP4): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Project implementation could affect water quality in the extended study area, but effects would diminish with distance. This impact would be less than significant.

This impact would be similar to Impact WQ-16 (CP1). For the same reasons described for Impact WQ-16 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-17 (CP4): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-17 (CP1). Analysis of temperature modeling shows little to no change in temperature at RBPP caused by CP4. This suggests that there would be no changes in temperature beyond RBPP as a result of CP4. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-18 (CP4): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact would be similar to Impact WQ-18 (CP1). For the same reasons described for Impact WQ-18 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-19a (CP4): Delta Salinity on the Sacramento River at Collinsville This impact would be the same as Impact WQ-19a (CP1). Operations for CP4 would result in both increases and decreases in salinity; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. On a percentage basis, all increases in salinity would be less than 5 percent. The operation of CP4 would not result in any violations of the salinity standards for the Sacramento River at Collinsville under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19b (CP4): Delta Salinity on the Sacramento River at Jersey Point This impact would be the same as Impact WQ-19b (CP1). On an average monthly basis, EC would meet the requirements in all months in an average year. On a percentage basis, all increases in salinity would be less than 5 percent. Furthermore, all changes during April through August would be less than 2 percent. Overall, the frequency of exceedence of salinity standards for the San Joaquin River at Jersey Point under CP4 would be similar to those under Existing and Future conditions.

The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19c (CP4): Delta Salinity on the Sacramento River at Emmaton This impact would be the same as Impact WQ-19c (CP1). On an average monthly basis, EC would meet the requirements in all months on an average annual basis. On a percentage basis, all increases in salinity would be less than 5 percent. Operations of CP4 would not result in any additional violation of salinity standards between October and March. CP4 would result in an increase in the frequency of violations under Existing and Future Conditions during May, by up to 100 percent in all years and dry and critical years. However, CP4 would result in a decrease in the frequency of violations under Existing and Future Conditions during August and April, by up to 11.5 percent in all years and up to 50 percent during dry and critical years. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19d (CP4): Delta Salinity on the Old River at Rock Slough This impact would be similar to Impact WQ-19d (CP1). On an average annual basis, all months except October through January under both the Existing Condition and Future Condition would be less than 150 mg/L. This impact would be less than significant.

In average annual years, CP4 would not increase chlorides by more than 1.1 percent. Maximum change in chloride concentrations under the CP4 are less than 2.1 percent for dry and critical years. The change in chloride concentration would not affect compliance with the standard; it would already be exceeded under the basis of comparison.

This impact would be the same as Impact WQ-19d (CP1). The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19e (CP4): Delta Salinity on the Delta-Mendota Canal at Jones Pumping Plant The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. CP4 would not cause exceedence of chloride thresholds. All increases in chloride concentrations would be less than 5 percent. Chloride values under CP4 would be similar to the baseline values under both Existing and Future conditions. Increases in EC would be less than 5 percent under CP4 and would not exceed the EC threshold. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19f (CP4): Delta Salinity on the West Canal at Clifton Court Forebay This impact would be the same as WQ-19f (CP1). The 250 mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under CP1. CP1 would also not exceed EC thresholds. This impact would be less than significant.

This impact would be the same as Impact WQ-19f (CP1). The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19g (CP4): Delta Salinity on the San Joaquin River near Vernalis This impact would be the same as Impact WQ-19g (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP4 would not exceed EC thresholds on the San Joaquin River at Vernalis. This impact would be less than significant. CP1 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19h (CP4): Delta Salinity on the San Joaquin River at Brandt Bridge This impact would be the same as Impact WQ-19h (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP4 would not change EC on the San Joaquin River at Brandt Bridge. CP1 would not change the existing compliance level under both existing and future project conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19i (CP4): Delta Salinity on the Old River near the Middle River Impact WQ-19i (CP4) would be similar to Impact WQ-19i (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP4 would not measurably change EC on the Old River near the Middle River. Compliance with salinity standards for the Old River near the Middle River would not change under CP4. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-19j (CP4): Delta Salinity on the Old River near Tracy Road Bridge This impact would be similar to Impact WQ-19j (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP4 would not measurably change EC on the Old River at Tracy Road Bridge. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-20 (CP4): X2 Position This impact would be the same as WQ-20 (CP1). CP4 would not change average monthly X2 in either average years or in dry and critical years by more than 0.1 km under either the Existing Condition or Future Condition. Although several months may be out of compliance individually under the bases of comparison, this impact would be less than significant.

The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

CP5 primarily focuses on increasing water supply reliability, anadromous fish survival, Shasta Lake area environmental resources, and recreation opportunities. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP5 would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 150 TAF and 75 TAF, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus in increasing M&I deliveries. CP5 also includes constructing additional fish habitat in and along the shoreline of Shasta Lake and along the lower reaches of its tributaries; augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River; and increasing recreation opportunities at Shasta Lake.

CP5 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Shasta Lake and Vicinity

Impact WQ-1 (CP5): Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-1 (CP3). However, CP5 includes several ecosystem restoration projects that would require temporary construction-related activities, as described in Chapter 2, “Alternatives.”

Although the environmental protection measures and BMPs described in Chapter 2, “Alternatives,” are intended to reduce the potential effects of introducing sediment into Shasta Lake and its tributaries, CP5 would affect water quality by increasing the levels of turbidity and suspended sediment in the receiving waters at levels that could be inconsistent with the Basin Plan. These increased levels of turbidity and suspended sediment could affect the beneficial uses of Shasta Lake and/or its tributaries. Therefore, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-2 (CP5): Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact would be similar to Impact WQ-2 (CP3). The nature of inundation impacts is consistent with those described for CP3. However, relocation activities under CP5 would expose a similar but greater acreage to erosion than would CP3 (up to 3,337 acres). The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-3 (CP5): Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to WQ-3 (CP1). No construction activities would disturb locations known to contain elevated metal concentrations in either sediments or the water column. Therefore, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-4 (CP5): Long-Term Sediment Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact is similar to WQ-4 (CP3). Although some ecosystem enhancement measures (i.e., road restoration) are expected to reduce the long-term sediment delivery to Shasta Lake and its tributaries, CP5 would nonetheless result in increased levels of suspended sediment and turbidity that could affect beneficial uses. The amount of sediment that could be delivered is not quantifiable because of the size of the lake and the number of variables that influence sediment transport and delivery. The impact would be a potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-5 (CP5): Long-Term Temperature Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries Similar to the discussion in CP3, this alternative would increase storage on a monthly basis although it would vary by water year. Table 7-120 illustrates the monthly change in simulated storage for CP5 as a percent increase above the No-Action Alternative. On average, CP5 represents an approximately 13 percent increase in the end-of-month storage on an annual basis. This impact would be less than significant.

Table 7-120. Simulated Average End-of-Month Shasta Lake Storage – CP5

Month	Existing Conditions (TAF)	CP5 (TAF)	CP5 % Increase
October	2,592	383	14.8%
November	2,568	373	14.5%
December	2,722	409	15.0%
January	2,995	428	14.3%
February	3,267	449	13.7%
March	3,625	460	12.7%
April	3,916	451	11.5%
May	3,941	452	11.5%
June	3,639	447	12.3%
July	3,160	428	13.6%
August	2,834	422	14.9%
September	2,669	404	15.1%

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node S4+S44)
Note:
Simulation period: 1922-2003
Key:
TAF = thousand acre-feet

Consistent with the discussion presented under CP3, existing water temperature requirements would typically be met in most years. The simulated end-of-April volume of water with a temperature lower than 52°F for the No-Action Alternative and the change in CWP volume for CP5 is shown, by SVI, in Table 7-121.

Table 7-121. Simulated Average Volume of Water Less than 52°F in Shasta Lake at the End of April – CP5

SVI Year Type	Existing Conditions (TAF)	CP5 (TAF)	% Increase
Average of All Years	2,609	378	15%
Wet	2,804	500	18%
Above Normal	2,972	439	15%
Below Normal	2,699	357	13%
Dry	2,542	317	12%
Critical	1,601	142	9%

Source: BST (Benchmark Study Team) April 2010 version SRWQM 2005 and 2030 simulations

Note:
Simulation period: 1922-2003
Year types as defined by the Sacramento Valley Index

Key:
SVI = Sacramento Valley Index
TAF = thousand acre-feet

In addition to illustrating the average change in available CWP, this table also shows the influence of climatic conditions on these values. The diversity between water year types, coupled with unique combinations of storage and rainfall would continue to influence the ability to manage storage in Shasta Lake to maximize carryover capacity. Although a meaningful increase in active storage and carryover storage of the CWP would occur, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-6 (CP5): Long-Term Metals Effects that Would Violate Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries This impact is similar to CP1. The nature of inundation impacts is consistent with those described for CP3. The impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact WQ-7 (CP5): Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction would include ground-disturbing activities that could result in soil erosion and sediment effects on the upper Sacramento River. This impact would be potentially significant.

Ground-disturbing activities associated with construction could cause soil erosion and sedimentation of local drainages and eventually the Sacramento River. Construction activities could also discharge waste petroleum products or other construction-related substances that could enter these waterways/facilities in runoff. As described for Impact WQ-7 (CP4), gravel augmentation construction activities could also adversely affect water quality and temporarily increase turbidity and sedimentation downstream from the gravel augmentation sites.

In addition, riparian, floodplain, and side channel habitat restoration activities as part of CP5 would involve breaching the levee using an excavator, loader, and compaction equipment and excavation of approximately 15,650 cubic yards of earthen material for off-site disposal, and potential vegetation clearing along 0.8 mile of channel. Invasive aquatic vegetation would be removed as well. As described for Impact WQ-7 (CP4), construction activities related to habitat restoration and vegetation clearing could adversely affect water quality and temporarily increase turbidity and sedimentation downstream, or result in the accidental discharge of construction-related substances into the river channel. In addition, excavated sediments could be contaminated with pesticides and metals. Development and implementation of a SWPPP as part of the environmental commitments described in Chapter 2, “Alternatives,” would reduce potential impacts related to pesticides and metals. However, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-8 (CP5): Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in temperature effects on the upper Sacramento River because changes to water temperature in Shasta Lake and subsequent releases to the Sacramento River would be consistent with typical periodic fluctuations. This impact would be less than significant.

This impact would be similar to Impact WQ-8 (CP1). For the same reasons described for Impact WQ-8 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-9 (CP5): Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction activities are not anticipated to result in water quality effects on the upper Sacramento River related to metals because construction would not disturb locations of known elevated metal concentrations. This impact would be less than significant.

This impact would be similar to Impact WQ-9 (CP1). For the same reasons described for Impact WQ-9 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-10 (CP5): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River No long-term water quality impacts are anticipated in the upper Sacramento River in regard to sediment because modeling results have indicated that CP5 would cause little change in average mean monthly flow, and could cause a decrease in peak flows that are associated with increased sediment transport. This impact would be less than significant.

This impact would be similar to Impact WQ-10 (CP1) because the extent of the effect of CP5 on sediment would be similar to that for CP1. For the same reasons as described for Impact WQ-10 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-11 (CP5): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Analysis of temperature modeling results indicates that CP5 would improve compliance with the temperature requirements on the Sacramento River because of the increased depth of the cold-water pool in Shasta Lake and the associated enhanced ability to regulate water temperature releases to the upper Sacramento River. Therefore, the impact on water quality measured as temperature would be beneficial.

CP5 would increase the ability of Shasta Dam to release cold water and regulate water temperature in the upper Sacramento River, primarily in dry and critical years. Raising Shasta Dam 18.5 feet would increase the cold-water pool and benefit seasonal water temperatures along the upper Sacramento River. This section focuses on compliance with water quality standards for temperature. For an analysis of temperature effects on fisheries and aquatic habitat, see Chapter 11, “Fisheries and Aquatic Resources.”

CP5 is the same as CP3 for both flow and temperature characteristics. Therefore, separate temperature modeling was not completed for CP5. See Impact WQ-11 (CP3) for a more complete discussion on temperature modeling analysis. For the same reasons as described for Impact WQ-11 (CP3), the impact would be beneficial. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-12 (CP5): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River Long-term operation of the project could result in water quality effects on the upper Sacramento River in regard to metals as a result of erosional processes to historic mining and smelting operation features. This impact would be potentially significant.

This impact would be similar to Impact WQ-12 (CP1) because the extent of the effect of CP5 on metals would be similar to that for CP1. For the same reasons as described for Impact WQ-12 (CP1), the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact WQ-13 (CP5): Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses Construction is not anticipated to affect water quality conditions in the extended study area. This impact would be less than significant.

This impact is similar to Impact WQ-13 (CP1). For the same reasons as described for Impact WQ-13 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-14 (CP5): Temporary Construction-Related Temperature Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to Impact WQ-14 (CP1). For the same reasons as described for Impact WQ-14 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-15 (CP5): Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses This impact is similar to Impact WQ-15 (CP1). For the same reasons as described for Impact WQ-15 (CP1), the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-16 (CP5): Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area Project implementation could affect water quality in the extended study area, but effects would diminish with distance. This impact would be less than significant.

This impact is similar to Impact WQ-16 (CP1). For the same reasons as described for CP1, the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-17 (CP5): Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact is similar to Impact WQ-17 (CP1). Analysis of temperature modeling shows little to no change in temperature at RBPP caused by CP5. This suggests that no changes in temperature would occur beyond RBPP as a result of CP5. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact WQ-18 (CP5): Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area This impact is similar to Impact WQ-18 (CP1). For the same reasons as described for CP1, the impact would be potentially significant. Mitigation for this impact is proposed in Section 7.3.5.

Impact WQ-19a (CP5): Delta Salinity on the Sacramento River at Collinsville
Impact WQ-19a (CP5) would be similar to Impact WQ-19a (CP1). This impact would be less than significant.

As shown in Table 7-122, operations for CP5 result in both increases and decreases in salinity; however, none of the increases would be sufficient to change compliance for the Sacramento River at Collinsville. Similarly, on a percentage basis, all increases in salinity would be less than 1 percent; this would be within the range of natural variability. Table 7-123 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Collinsville in the period of simulation. The operation of CP5 would not result in any violation of the salinity standards under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-122. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Collinsville Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	6.0	-0.1 (-1.1%)	7.1	-0.1 (-1.0%)	6.0	-0.1 (-1.3%)	7.1	0.0 (0.0%)
November	5.1	0.0 (-0.2%)	6.8	-0.1 (-1.1%)	5.1	0.0 (-0.1%)	6.9	0.0 (0.0%)
December	3.6	0.0 (0.0%)	5.5	0.0 (-0.1%)	3.6	0.0 (-0.4%)	5.5	0.0 (0.0%)
January	1.8	0.0 (-0.1%)	3.4	0.0 (0.2%)	1.7	0.0 (-0.5%)	3.3	0.0 (0.1%)
February	0.8	0.0 (0.4%)	1.7	0.0 (1.2%)	0.8	0.0 (0.2%)	1.6	0.0 (0.0%)
March	0.6	0.0 (-0.1%)	1.2	0.0 (-0.5%)	0.6	0.0 (0.6%)	1.1	0.0 (0.0%)
April	0.7	0.0 (-0.9%)	1.4	0.0 (-1.2%)	0.7	0.0 (-0.8%)	1.5	0.0 (0.0%)
May	1.1	0.0 (-0.9%)	2.3	0.0 (-0.9%)	1.1	0.0 (-1.0%)	2.4	0.0 (0.0%)
June	2.2	0.0 (-0.1%)	4.0	0.0 (-0.2%)	2.2	0.0 (0.4%)	4.1	0.0 (0.0%)
July	3.2	0.0 (-0.2%)	5.3	0.0 (-0.6%)	3.2	0.0 (-0.1%)	5.5	0.0 (0.0%)
August	5.3	0.0 (-0.3%)	7.3	-0.1 (-0.9%)	5.4	0.0 (-0.5%)	7.4	0.0 (0.0%)
September	5.2	-0.1 (-1.0%)	8.8	-0.2 (-1.7%)	5.2	-0.1 (-1.6%)	8.8	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-123. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Collinsville Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC081)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Impact WQ-19b (CP5): Delta Salinity on the San Joaquin River at Jersey Point

Impact WQ-19b (CP5) would be similar to Impact WQ-19b (CP1). On an average monthly basis, EC would meet the requirements in all months in an average year. Moreover, CP5 would not increase the EC at Jersey Point. On a percentage basis, all increases in salinity would be less than 5 percent. This impact would be less than significant.

As shown in Table 7-124, the basis of comparison would meet the requirement on an average basis in both average years and in dry and critical years. Furthermore, all changes during April through August would be less than 2 percent. Table 7-125 shows the number of months simulated EC values exceeded the standards for San Joaquin River at Jersey Point in the period of simulation. CP5 would result in an increase in the frequency of violations under Future Conditions during July, by 2 percent in all years and 4.8 percent during dry and critical years. However, CP5 would result in a decrease in the frequency of violations under Future Conditions during August, by 1.3 percent in all years and 3.7 percent during dry and critical years. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-124. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Jersey Point Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	1.6	0.0 (-0.5%)	1.8	0.0 (-1.2%)	1.6	0.0 (-0.7%)	1.9	0.0 (0.0%)
November	1.5	0.0 (1.3%)	1.8	0.0 (0.3%)	1.5	0.0 (1.7%)	1.8	0.0 (0.0%)
December	1.2	0.0 (0.9%)	1.8	0.0 (0.3%)	1.2	0.0 (0.5%)	1.7	0.0 (0.0%)
January	0.7	0.0 (0.2%)	1.1	0.0 (0.7%)	0.7	0.0 (0.6%)	1.0	0.0 (0.1%)
February	0.3	0.0 (1.2%)	0.5	0.0 (2.5%)	0.3	0.0 (2.1%)	0.5	0.0 (0.0%)
March	0.3	0.0 (0.2%)	0.3	0.0 (0.6%)	0.3	0.0 (0.8%)	0.3	0.0 (0.0%)
April	0.3	0.0 (-0.3%)	0.3	0.0 (-0.4%)	0.3	0.0 (0.1%)	0.3	0.0 (0.0%)
May	0.3	0.0 (-0.2%)	0.4	0.0 (-0.4%)	0.3	0.0 (0.1%)	0.4	0.0 (0.0%)
June	0.4	0.0 (0.0%)	0.7	0.0 (-0.1%)	0.4	0.0 (0.5%)	0.7	0.0 (0.0%)
July	1.0	0.0 (0.7%)	1.7	0.0 (0.9%)	1.0	0.0 (1.5%)	1.7	0.0 (0.0%)
August	1.6	0.0 (-0.1%)	2.2	0.0 (-0.3%)	1.6	0.0 (0.2%)	2.1	0.0 (0.0%)
September	1.9	0.0 (0.6%)	2.8	0.0 (0.9%)	1.9	0.0 (0.8%)	2.8	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-125. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Jersey Point Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	10	0.0 (0.0%)	8	0.0 (0.0%)	13	0.0 (0.0%)	11	0.0 (0.0%)
July	51	0.0 (0.0%)	22	0.0 (0.0%)	50	1.0 (2.0%)	21	1.0 (4.8%)
August	73	0.0 (0.0%)	25	0.0 (0.0%)	76	-1.0 (-1.3%)	27	-1.0 (-3.7%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN018)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19c (CP5): Delta Salinity on the Sacramento River at Emmaton

On an average monthly basis, EC would meet the requirements in all months on an average annual basis; moreover, CP5 would not increase the EC at Emmaton during this period by more than 1.4 percent. This impact would be less than significant.

Impact WQ-19c (CP5) would be similar to Impact WQ-19c (CP1). Although Table 7-126 shows EC for all months, the Emmaton water quality requirement is only defined for April 1 through August 15. On an average monthly basis, EC would meet requirements in all months on an average annual basis. Table 7-127 shows the number of months simulated EC values exceeded the standards for the Sacramento River at Emmaton in the period of simulation. Operations of CP5 would not result in any violation of salinity standards between October and March. CP5 would result in an increase in the frequency of violations under Existing and Future Conditions during May, by up to 33.3 percent in all years and dry and critical years. However, CP5 would result in a decrease in the frequency of violations under Existing and Future Conditions during April and August, by up to 50 percent in the average of all years and dry and critical years. Overall, the compliance of salinity standards for the Sacramento River at Emmaton would be very similar to the baseline levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-126. Simulated Monthly Average Salinity and Percent Change for the Sacramento River at Emmaton Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	2.0	0.0 (-2.3%)	2.4	0.0 (-2.0%)	2.0	-0.1 (-2.6%)	2.5	0.0 (0.0%)
November	1.5	0.0 (-1.2%)	2.2	-0.1 (-2.5%)	1.5	0.0 (-1.2%)	2.3	0.0 (0.0%)
December	1.0	0.0 (-0.5%)	1.5	0.0 (-0.7%)	0.9	0.0 (-1.2%)	1.5	0.0 (0.0%)
January	0.5	0.0 (0.1%)	0.7	0.0 (0.4%)	0.4	0.0 (-0.7%)	0.7	0.0 (0.1%)
February	0.3	0.0 (0.5%)	0.4	0.0 (1.4%)	0.3	0.0 (0.4%)	0.4	0.0 (0.0%)
March	0.2	0.0 (-0.1%)	0.3	0.0 (-0.1%)	0.2	0.0 (0.7%)	0.3	0.0 (0.0%)
April	0.3	0.0 (-0.6%)	0.3	0.0 (-0.9%)	0.3	0.0 (-0.3%)	0.4	0.0 (0.0%)
May	0.3	0.0 (-0.5%)	0.5	0.0 (-0.6%)	0.3	0.0 (-0.6%)	0.6	0.0 (0.0%)
June	0.6	0.0 (0.0%)	1.1	0.0 (-0.1%)	0.6	0.0 (0.5%)	1.1	0.0 (0.0%)
July	0.7	0.0 (-0.9%)	1.3	0.0 (-1.4%)	0.8	0.0 (-1.2%)	1.4	0.0 (0.0%)
August	1.4	0.0 (-0.7%)	2.3	0.0 (-1.4%)	1.5	0.0 (-1.3%)	2.3	0.0 (0.0%)
September	1.6	0.0 (-2.8%)	3.0	-0.1 (-4.2%)	1.6	-0.1 (-3.6%)	3.1	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-127. Simulated Number of Months of Exceedence of the Salinity Standard for the Sacramento River at Emmaton Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	1	0.0 (0.0%)	1	0.0 (0.0%)	2	-1.0 (-50.0%)	2	-1.0 (-50.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	3	1.0 (33.3%)	3	1.0 (33.3%)
June	28	0.0 (0.0%)	18	0.0 (0.0%)	27	0.0 (0.0%)	19	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	69	-2.0 (-2.9%)	26	-2.0 (-7.7%)	70	-2.0 (-2.9%)	26	-2.0 (-7.7%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAC092)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19d (CP5): Delta Salinity on the Old River at Rock Slough Impact WQ-19d (CP5) would be similar to Impact WQ-19d (CP1). On an average annual basis, all months except September through January under both the Existing Condition and Future Condition would be less than 150 mg/L. This impact would be less than significant.

Table 7-128 shows simulated monthly average chloride concentrations and percent change for the Old River at Rock Slough. In average annual years, CP5 would not increase chlorides by more than 1.0 percent. Maximum change in chloride concentrations under the CP5 are less than 1.2 percent for dry and critical years. Change in chloride concentration would not affect compliance with the standard; it would already be exceeded under the basis of comparison.

Table 7-129 shows the number of days simulated chloride values exceeded the standards of 150 mg/L for the Old River at Rock Slough in the period of simulation. No daily violations of the chloride standards would occur under both existing and future conditions for CP5. Overall, CP5 would not alter the compliance level observed under the Existing and Future conditions.

Table 7-128. Simulated Monthly Average Chlorides and Percent Change for the Old River at Rock Slough Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP5 Change (mg/L (%))	Existing Condition (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))
October	156.2	-0.5 (-0.3%)	175.6	-1.8 (-1.0%)	157.1	-0.5 (-0.3%)	176.7	0.0 (0.0%)
November	154.9	-1.2 (-0.8%)	177.7	-2.2 (-1.2%)	155.3	-1.0 (-0.6%)	181.1	-0.1 (-0.1%)
December	144.3	1.4 (1.0%)	178.3	0.0 (0.0%)	151.7	0.3 (0.2%)	186.7	-0.1 (-0.1%)
January	153.9	1.0 (0.7%)	183.5	1.8 (1.0%)	164.9	1.2 (0.7%)	197.1	0.1 (0.1%)
February	106.2	-0.2 (-0.2%)	112.3	0.6 (0.5%)	119.2	0.6 (0.5%)	115.5	0.1 (0.0%)
March	95.2	-0.9 (-1.0%)	92.3	0.0 (0.0%)	103.8	0.5 (0.5%)	95.6	0.0 (0.0%)
April	88.4	-0.6 (-0.7%)	86.6	-0.2 (-0.2%)	90.0	0.3 (0.4%)	85.4	0.0 (0.0%)
May	90.4	-0.3 (-0.3%)	92.3	-0.2 (-0.2%)	87.5	0.1 (0.1%)	87.2	0.0 (0.0%)
June	62.4	-0.1 (-0.1%)	75.8	-0.1 (-0.1%)	61.5	0.1 (0.1%)	75.4	0.0 (0.0%)
July	73.8	0.4 (0.5%)	111.3	0.9 (0.8%)	76.6	0.7 (0.9%)	115.5	0.0 (0.0%)
August	117.0	0.5 (0.4%)	182.4	1.2 (0.7%)	122.0	1.0 (0.8%)	186.3	0.0 (0.0%)
September	158.5	-0.2 (-0.1%)	210.3	-0.3 (-0.1%)	167.1	0.3 (0.2%)	208.4	0.0 (0.0%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006) converted to chlorides using the equation EC*0.268-24*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-129. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Old River at Rock Slough Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	17	0 (0%)	7	0 (0%)	17	0 (0%)	7	0 (0%)
November	16	0 (0%)	7	0 (0%)	16	0 (0%)	7	0 (0%)
December	14	0 (0%)	7	0 (0%)	15	0 (0%)	7	0 (0%)
January	13	0 (0%)	7	0 (0%)	16	0 (0%)	8	0 (0%)
February	5	0 (0%)	2	0 (0%)	7	0 (0%)	2	0 (0%)
March	3	0 (0%)	1	0 (0%)	5	0 (0%)	0	0 (0%)
April	1	0 (0%)	0	0 (0%)	1	0 (0%)	0	0 (0%)
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	3	0 (0%)	3	0 (0%)	3	0 (0%)	3	0 (0%)
August	10	0 (0%)	10	0 (0%)	11	0 (0%)	10	0 (0%)
September	18	0 (0%)	11	0 (0%)	20	0 (0%)	11	0 (0%)
Total	99	0 (0%)	54	0 (0%)	111	0 (0%)	56	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCCC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Impact WQ-19e (CP5): Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant This impact would be similar to Impact WQ-19e (CP1). The water quality requirement on the Delta-Mendota Canal at Jones Pumping Plant has two components, a chloride requirement and an EC requirement. Tables 7-130 and 7-131 show that CP5 would not cause exceedence of chloride thresholds. All increases in chloride concentrations would be less than 5 percent. Chloride values under CP5 would be similar to the baseline values under both Existing and Future conditions. Tables 7-132 and 7-133 show that increases in EC would be less than 1.0 percent and would not exceed the EC threshold. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-130. Simulated Monthly Average Chlorides and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP5 Change (mg/L (%))	Existing Condition (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))
October	107.1	-0.5 (-0.5%)	117.9	-1.4 (-1.2%)	105.1	-0.9 (-0.9%)	117.0	0.0 (0.0%)
November	105.8	-0.7 (-0.6%)	118.9	-0.9 (-0.7%)	103.1	-0.6 (-0.6%)	118.4	-0.1 (-0.1%)
December	124.1	0.8 (0.6%)	142.3	0.3 (0.2%)	118.1	0.8 (0.7%)	136.7	0.0 (0.0%)
January	141.4	0.1 (0.0%)	165.9	0.0 (0.0%)	129.5	0.1 (0.0%)	151.2	0.1 (0.0%)
February	123.6	-0.5 (-0.4%)	159.4	-0.7 (-0.5%)	113.7	-0.1 (0.0%)	148.2	0.0 (0.0%)
March	106.9	-0.6 (-0.5%)	157.9	-0.4 (-0.3%)	97.1	0.3 (0.3%)	146.9	0.0 (0.0%)
April	84.0	-0.1 (-0.1%)	123.4	-0.1 (-0.1%)	68.6	0.2 (0.2%)	108.4	0.0 (0.0%)
May	75.3	0.0 (0.0%)	106.4	-0.1 (-0.1%)	66.0	0.0 (0.0%)	97.7	0.0 (0.0%)
June	66.4	-0.1 (-0.1%)	81.4	0.0 (0.0%)	60.8	0.0 (0.0%)	75.6	0.0 (0.0%)
July	60.8	0.3 (0.5%)	83.1	0.9 (1.1%)	58.8	0.5 (0.8%)	82.1	0.0 (0.0%)
August	82.2	0.5 (0.7%)	121.9	1.3 (1.1%)	80.6	0.6 (0.8%)	121.2	0.0 (0.0%)
September	109.5	0.2 (0.2%)	145.0	0.9 (0.6%)	107.5	0.2 (0.2%)	141.7	0.0 (0.0%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-131. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-132. Simulated Monthly Average Salinity and Percent Change for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.6	0.0 (-0.4%)	0.6	0.0 (-0.9%)	0.5	0.0 (-0.6%)	0.6	0.0 (0.0%)
November	0.5	0.0 (-0.4%)	0.6	0.0 (-0.5%)	0.5	0.0 (-0.4%)	0.6	0.0 (0.0%)
December	0.6	0.0 (0.5%)	0.7	0.0 (0.1%)	0.6	0.0 (0.5%)	0.7	0.0 (0.0%)
January	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
February	0.6	0.0 (-0.3%)	0.7	0.0 (-0.4%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
March	0.6	0.0 (-0.4%)	0.7	0.0 (-0.2%)	0.5	0.0 (0.2%)	0.7	0.0 (0.0%)
April	0.5	0.0 (-0.1%)	0.6	0.0 (-0.1%)	0.4	0.0 (0.1%)	0.6	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.4	0.0 (0.0%)
July	0.4	0.0 (0.3%)	0.5	0.0 (0.7%)	0.4	0.0 (0.4%)	0.5	0.0 (0.0%)
August	0.5	0.0 (0.4%)	0.6	0.0 (0.8%)	0.5	0.0 (0.5%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.1%)	0.7	0.0 (0.5%)	0.6	0.0 (0.1%)	0.7	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-133. Simulated Number of Months of Exceedence of the Salinity Standard for the Delta-Mendota Canal at the Jones Pumping Plant Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHCDMC006)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19f (CP5): Delta Water Quality in the West Canal at the Mouth of the Clifton Court Forebay This impact would be similar to Impact WQ-19f (CP1). The 250-mg/L chloride concentration standard at the West Canal would not be exceeded on an average annual or dry and critical year basis under CP5. CP5 would also not exceed EC thresholds. This impact would be less than significant.

Table 7-134 shows that maximum chloride concentrations under both existing and future project conditions are lower for CP5 than the 250 mg/L threshold. Maximum changes under both existing and future projection conditions are less than 1.5 percent. As shown in Table 7-135, CP5 the maximum change in EC values under existing and future project conditions would be less than 1percent.

Table 7-134. Simulated Monthly Average Chlorides and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mg/L)	CP5 Change (mg/L (%))	Existing Condition (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))	No-Action Alternative (mg/L)	CP5 Change (mg/L (%))
October	110.8	-0.6 (-0.5%)	124.3	-1.7 (-1.4%)	110.4	-1.0 (-0.9%)	125.1	0.0 (0.0%)
November	107.2	-0.4 (-0.4%)	123.4	-1.0 (-0.8%)	105.7	-0.2 (-0.2%)	124.8	-0.1 (-0.1%)
December	109.2	1.2 (1.1%)	131.8	0.3 (0.3%)	107.0	1.2 (1.1%)	131.1	0.0 (0.0%)
January	128.1	0.5 (0.4%)	154.3	0.9 (0.6%)	120.5	0.1 (0.1%)	145.3	0.1 (0.1%)
February	107.5	-0.5 (-0.5%)	134.7	-0.3 (-0.2%)	99.2	0.3 (0.3%)	124.2	0.0 (0.0%)
March	91.9	-0.6 (-0.7%)	132.1	-0.2 (-0.1%)	83.6	0.6 (0.7%)	122.4	0.0 (0.0%)
April	75.6	-0.1 (-0.2%)	110.3	-0.2 (-0.2%)	60.8	0.3 (0.6%)	96.4	0.0 (0.0%)
May	70.8	0.0 (0.0%)	99.9	-0.1 (-0.1%)	61.6	0.1 (0.1%)	91.6	0.0 (0.0%)
June	56.4	-0.1 (-0.1%)	73.4	0.0 (-0.1%)	51.8	0.0 (-0.1%)	68.6	0.0 (0.0%)
July	52.2	0.4 (0.8%)	82.6	1.1 (1.3%)	51.3	0.5 (0.9%)	82.3	0.0 (0.0%)
August	80.5	0.2 (0.3%)	128.2	0.5 (0.4%)	80.4	0.6 (0.7%)	127.5	0.0 (0.0%)
September	115.0	0.3 (0.2%)	157.5	0.9 (0.6%)	114.9	0.4 (0.3%)	154.7	0.0 (0.0%)

*Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003) converted to chlorides using the equation EC*0.273-43.9)*

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
EC = electrical conductivity
mg/L = milligrams per liter

Table 7-135. Simulated Monthly Average Salinity and Percent Change for West Canal at the Clifton Court Forebay Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.6	0.0 (-0.4%)	0.6	0.0 (-1.0%)	0.6	0.0 (-0.6%)	0.6	0.0 (0.0%)
November	0.6	0.0 (-0.3%)	0.6	0.0 (-0.6%)	0.5	0.0 (-0.1%)	0.6	0.0 (-0.1%)
December	0.6	0.0 (0.8%)	0.6	0.0 (0.2%)	0.6	0.0 (0.8%)	0.6	0.0 (0.0%)
January	0.6	0.0 (0.3%)	0.7	0.0 (0.5%)	0.6	0.0 (0.1%)	0.7	0.0 (0.1%)
February	0.6	0.0 (-0.3%)	0.7	0.0 (-0.2%)	0.5	0.0 (0.2%)	0.6	0.0 (0.0%)
March	0.5	0.0 (-0.5%)	0.6	0.0 (-0.1%)	0.5	0.0 (0.5%)	0.6	0.0 (0.0%)
April	0.4	0.0 (-0.1%)	0.6	0.0 (-0.1%)	0.4	0.0 (0.3%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.5	0.0 (-0.1%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.4	0.0 (-0.1%)	0.4	0.0 (0.0%)	0.4	0.0 (0.0%)	0.4	0.0 (0.0%)
July	0.4	0.0 (0.4%)	0.5	0.0 (0.8%)	0.3	0.0 (0.5%)	0.5	0.0 (0.0%)
August	0.5	0.0 (0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.5%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.2%)	0.7	0.0 (0.5%)	0.6	0.0 (0.2%)	0.7	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-136 shows the average number of days simulated chloride values exceeded the standards of 250 mg/L for the West Canal at the Clifton Court Forebay in a year. There would be no additional violations throughout the year under both existing and future project conditions. CP5 would not change the baseline compliance levels under both Existing and Future conditions.

As shown in Table 7-137, CP5 would not result in any additional violations of the salinity standards. CP5 would actually result in decreases in EC during several months of the year. CP5 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-136. Simulated Number of Days by Month of Exceedence of the Chloride Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))	(Number of days)	(Number of days (%))
October	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
November	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
December	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
January	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
February	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
March	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
April	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
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%)
August	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
September	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)
Total	0	0 (0%)	0	0 (0%)	0	0 (0%)	0	0 (0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.
Percentage values reported in parenthesis are reported as zero if the change is less than one day.

Key:
CP = Comprehensive Plan

Table 7-137. Simulated Number of Months of Exceedence of the Salinity Standard for the West Canal at the Clifton Court Forebay Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	3	-3.0 (-100.0%)	2	-2.0 (-100.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	2	-1.0 (-50.0%)	1	0.0 (0.0%)
January	1	-1.0 (-100.0%)	1	-1.0 (-100.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node CHSWP003)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19g (CP5): Delta Salinity on the San Joaquin River at Vernalis

This impact would be similar to Impact WQ-19g (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP5 would not exceed EC thresholds on the San Joaquin River at Vernalis, as shown in Tables 7-138 and 7-139. CP5 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-138. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Vernalis Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-139. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Vernalis Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP5 Change (Number of months (%))	Existing Condition (Number of months)	CP5 Change (Number of months (%))	No-Action Alternative (Number of months)	CP5 Change (Number of months (%))	No-Action Alternative (Number of months)	CP5 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	3	0.0 (0.0%)	3	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19h (CP5): Delta Salinity on the San Joaquin River at Brandt Bridge This impact would be the same as Impact WQ-19h (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. Moreover, CP5 would not measurably change EC on the San Joaquin River at Brandt Bridge. This impact would be less than significant.

This impact also would be similar to Impact WQ-19h (CP1). On an average monthly basis, EC would meet the requirements in all months in both average years and in dry and critical years. Moreover, CP5 would not measurably change EC on the San Joaquin River at Brandt Bridge, as shown in Table 7-140. Table 7-141 shows the number of months simulated EC values exceeded the standards for the San Joaquin River at Brandt Bridge in the period of simulation. CP5 would not change the existing compliance level for salinity standards for the San Joaquin River at Brandt Bridge. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-140. Simulated Monthly Average Salinity and Percent Change for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.1%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-141. Simulated Number of Months of Exceedence of the Salinity Standard for the San Joaquin River at Brandt Bridge Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition (Number of months)	CP5 Change (Number of months (%))	Existing Condition (Number of months)	CP5 Change (Number of months (%))	No-Action Alternative (Number of months)	CP5 Change (Number of months (%))	No-Action Alternative (Number of months)	CP5 Change (Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RSAN112)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19i (CP5): Delta Salinity on the Old River near the Middle River

On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP5 would not measurably change EC on the Old River near the Middle River, as shown in Table 7-142. This impact would be less than significant.

Table 7-143 shows the number of months simulated EC values exceeded the standards for the Old River near the Middle River in the period of simulation. Compliance with salinity standards for the Old River near the Middle River would not change under CP5 when compared to the Existing Conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-142. Simulated Monthly Average Salinity and Percent Change for the Old River near Middle River Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)	0.6	0.0 (0.0%)	0.7	0.0 (0.0%)
August	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-143. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River near Middle River Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
August	2	0.0 (0.0%)	2	0.0 (0.0%)	1	0.0 (0.0%)	1	0.0 (0.0%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node RMID041)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-19j (CP5): Delta Salinity on the Old River at Tracy Road Bridge
This impact would be similar to Impact WQ-19j (CP1). On an average monthly basis, EC would meet requirements in all months in both average years and in dry and critical years. CP5 would not measurably change EC on the Old River at Tracy Road Bridge, as shown in Table 7-144. This impact would be less than significant.

Table 7-145 shows the number of months simulated EC values exceeded the standards for the Old River near Tracy Road Bridge in the period of simulation. Although exceedence would occur during August, under future conditions, on an annual average basis, the compliance of salinity standards under CP2 would not change from the Existing Conditions. Overall, CP5 would not change the baseline compliance levels under both Existing and Future conditions. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-144. Simulated Monthly Average Salinity and Percent Change for the Old River at Tracy Road Bridge Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	Existing Condition (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))	No-Action Alternative (mmhos/cm)	CP5 Change (mmhos/cm (%))
October	0.5	0.0 (0.2%)	0.6	0.0 (0.3%)	0.5	0.0 (0.1%)	0.5	0.0 (0.0%)
November	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.1%)	0.6	0.0 (0.0%)
December	0.8	0.0 (0.0%)	0.8	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
January	0.8	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.8	0.0 (0.0%)
February	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)	0.7	0.0 (0.0%)	0.9	0.0 (0.0%)
March	0.6	0.0 (0.0%)	0.9	0.0 (0.0%)	0.6	0.0 (0.0%)	0.8	0.0 (0.0%)
April	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)
May	0.4	0.0 (0.0%)	0.6	0.0 (0.0%)	0.4	0.0 (0.0%)	0.5	0.0 (0.0%)
June	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)	0.5	0.0 (0.0%)	0.6	0.0 (0.0%)
July	0.6	0.0 (0.0%)	0.7	0.0 (-0.1%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
August	0.6	0.0 (-0.1%)	0.6	0.0 (-0.2%)	0.6	0.0 (0.0%)	0.6	0.0 (0.0%)
September	0.6	0.0 (0.0%)	0.6	0.0 (-0.1%)	0.5	0.0 (0.1%)	0.6	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
mmhos/cm = millimhos per centimeter

Table 7-145. Simulated Number of Months of Exceedence of the Salinity Standard for the Old River at Tracy Road Bridge Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Condition (2030)			
	Total All Years		Dry and Critical Years		Total All Years		Dry and Critical Years	
	Existing Condition	CP5 Change	Existing Condition	CP5 Change	No-Action Alternative	CP5 Change	No-Action Alternative	CP5 Change
	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))	(Number of months)	(Number of months (%))
October	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
November	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
December	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
January	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
February	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
March	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
April	7	0.0 (0.0%)	7	0.0 (0.0%)	5	0.0 (0.0%)	5	0.0 (0.0%)
May	1	0.0 (0.0%)	1	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
June	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
July	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)
August	4	0.0 (0.0%)	4	0.0 (0.0%)	3	2.0 (66.7%)	3	2.0 (66.7%)
September	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)	0	0.0 (0.0%)

Source: Version 8.0.6, DSM2 Existing and Future simulations (Node ROLD059)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan

Impact WQ-20 (CP5): X2 Position This impact would be similar to Impact WQ-20 (CP1). CP5 would not change average monthly X2 in either average years or in dry and critical years by more than 0.1 km under either the Existing Condition or Future Condition. Although several months may be out of compliance individually under the bases of comparison, the impact would be less than significant.

Table 7-146 shows the simulated monthly average X2 position for CP5 as compared to the Existing Condition and Future Condition baselines. CalSim-II calculates the X2 position on a 1-month delay; the values shown have been corrected to accurately reflect the X2 position for the specified month.

CP5 would not change average monthly X2 in either average years or in dry or critical years by more than 0.1 km under either the Existing Condition or the Future Condition. Although several months may be out of compliance under the bases of comparison, the change resulting from CP5 would not increase the amount out of compliance. The impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Table 7-146. Simulated Monthly Average X2 Position Under Baseline Conditions and CP5

Month	Existing Condition (2005)				Future Conditions (2030)			
	Average All Years		Dry and Critical Years		Average All Years		Dry and Critical Years	
	Existing Condition (km)	CP5 Change (km (%))	Existing Condition (km)	CP5 Change (km (%))	No-Action Alternative (km)	CP5 Change (km (%))	No-Action Alternative (km)	CP5 Change (km (%))
October	83.9	-0.1 (-0.1%)	86.6	-0.1 (-0.1%)	83.9	-0.1 (-0.1%)	86.5	0.0 (0.0%)
November	82.2	0.1 (0.1%)	86.5	-0.1 (-0.1%)	82.2	0.1 (0.1%)	86.6	0.0 (0.0%)
December	76.1	0.1 (0.1%)	84.8	0.0 (0.0%)	76.0	0.1 (0.1%)	84.7	0.0 (0.0%)
January	67.5	0.0 (0.0%)	79.6	0.0 (0.0%)	67.3	0.0 (0.0%)	79.2	0.0 (0.0%)
February	60.9	0.0 (0.1%)	72.5	0.1 (0.1%)	60.8	0.1 (0.1%)	72.3	0.0 (0.0%)
March	60.9	0.0 (0.1%)	70.3	0.0 (0.0%)	60.9	0.0 (0.0%)	70.3	0.0 (0.0%)
April	63.5	0.0 (-0.1%)	72.9	-0.1 (-0.1%)	63.4	0.0 (0.0%)	73.0	0.0 (0.0%)
May	67.5	0.0 (0.0%)	77.6	-0.1 (-0.1%)	67.7	0.0 (0.0%)	78.0	0.1 (0.1%)
June	74.5	0.0 (0.0%)	82.6	0.0 (-0.1%)	74.7	0.1 (0.1%)	82.8	0.0 (0.0%)
July	80.5	0.0 (0.0%)	86.1	0.0 (0.0%)	80.5	0.0 (0.1%)	86.1	0.0 (0.0%)
August	85.6	0.0 (0.0%)	88.8	-0.1 (-0.1%)	85.6	0.0 (0.0%)	88.6	0.0 (0.0%)
September	82.6	0.0 (-0.1%)	91.1	-0.1 (-0.2%)	82.6	-0.1 (-0.1%)	90.9	0.0 (0.0%)

Source: SLWRI 2012 Benchmark Version CalSim-II 2005 and 2030 simulations (Node X2_PRV)

Note:
Simulation period: 1922-2003. Change as measured from either Existing Condition or No-Action Alternative. Dry and critical years as defined by the Sacramento Valley Index.

Key:
CP = Comprehensive Plan
km = kilometer
X2 = geographic location of 2 parts per thousand near-bottom salinity isohaline in the Delta, measured in distance upstream from Golden Gate Bridge in Suisun Bay.

7.3.5 Mitigation Measures

Table 7-147 presents a summary of mitigation measures for water quality.

Table 7-147. Summary of Mitigation Measures for Water Quality

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-1: Temporary Construction-Related Sediment Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure WQ-1: Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-2: Temporary Construction-Related Temperature Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-3: Temporary Construction-Related Metal Effects on Shasta Lake and Its Tributaries that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-4: Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure WQ-4: Implement Mitigation Measure WQ-1 (CP1): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-5: Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-6: Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in Shasta Lake or Its Tributaries	LOS before Mitigation	LTS	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure WQ-6: Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-7: Temporary Construction-Related Sediment Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure WQ-7 (CP1–CP3): Implement Mitigation Measure WQ-1 (CP1): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities.			Mitigation Measure WQ-7 (CP4, CP5): Implement Mitigation Measure WQ-1 (CP1): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities and Gravel Augmentation BMPs.	
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-8: Temporary Construction-Related Temperature Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-9: Temporary Construction-Related Metal Effects on the Upper Sacramento River that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-10: Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-11: Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River	LOS before Mitigation	LTS	B	B	B	B	B
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	B	B	B	B	B

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-12: Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Upper Sacramento River	LOS before Mitigation	LTS	PS	PS	PS	PS	PS
	Mitigation Measure	None required	Mitigation Measure WQ-12: Implement Mitigation Measure WQ-6 (CP1): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-13: Temporary Construction-Related Sediment Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-14: Temporary Construction-Related Temperature Effects on the Extended Study Area that Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact WQ-15: Temporary Construction-Related Metal Effects on the Extended Study Area that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-16: Long-Term Sediment Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-17: Long-Term Temperature Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-18: Long-Term Metals Effects that Would Cause Violations of Water Quality Standards or Adversely Affect Beneficial Uses in the Extended Study Area	LOS before Mitigation	LTS	PS	PS	PS	PS	PS
	Mitigation Measure	Non required	Mitigation Measure WQ-18: Implement Mitigation Measure WQ-6 (CP1): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19a: Delta Salinity on the Sacramento River at Collinsville	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-19b: Delta Salinity on the San Joaquin River at Jersey Point	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19c: Delta Salinity on the Sacramento River at Emmaton	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19d: Delta Salinity on the Old River at Rock Slough	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19e: Delta Water Quality on the Delta-Mendota Canal at Jones Pumping Plant	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-19f: Delta Water Quality on the West Canal at the Mouth of the Clifton Court Forebay	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19g: Delta Salinity on the San Joaquin River at Vernalis	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19h: Delta Salinity on the San Joaquin River at Brandt Bridge	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-19i: Delta Salinity on the Old River near the Middle River	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Table 7-147. Summary of Mitigation Measures for Water Quality (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact WQ-19j: Delta Salinity on the Old River at Tracy Road Bridge	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact WQ-20: X2 Position	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	SU	LTS	LTS	LTS	LTS	LTS

Key:
B = beneficial
LTS = less than significant
NI = no impact
PS = potentially significant
SU = significant and unavoidable

No-Action Alternative

Under the No-Action Alternative, no action would be taken, including implementation of mitigation measures; rather, existing conditions would continue to change into the future. No mitigation measures are required for the No-Action Alternative. Thus, Impact WQ-20 (No-Action) would be significant and unavoidable.CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation measures are needed for Impacts WQ-2 (CP1), WQ-3 (CP1), WQ-5 (CP1), WQ-8 (CP1) through WQ-11 (CP1), WQ-13 (CP1) through WQ-17 (CP1), WQ-19a (CP1) through WQ-19j (CP1), and WQ-20 (CP1). Mitigation is provided below for the remaining impacts of CP1 on water quality.

Mitigation Measure WQ-1 (CP1): Prepare and Implement a Stormwater Pollution Prevention Program that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities This project is subject to construction-related stormwater permit requirements of the CWA NPDES program. Reclamation will obtain any required permits through the CVRWQCB before any ground-disturbing construction activity. Reclamation will prepare and implement a SWPPP that identifies BMPs to prevent or minimize the introduction of contaminants into surface waters. BMPs for the project could include but are not limited to silt fencing, straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrance.

The SWPPP will include development of site-specific structural and operational BMPs to prevent and control impacts on runoff quality, measures to be implemented before each storm event, inspection and maintenance of BMPs, and monitoring of runoff quality by visual and/or analytical means.

Implementation of this mitigation measure would reduce Impact WQ-1 (CP1) to a less-than-significant level.

Mitigation Measure WQ-4 (CP1): Implement Mitigation Measure WQ-1 (CP1) to Reduce Long-Term Effects on Shasta Lake and Its Tributaries Related to Sediment Reclamation will implement Mitigation Measure WQ-1 (CP1) as described above to reduce long-term effects related to sediment. The SWPPP may be customized to address long-term construction-related impacts associated with this impact. Implementation of this mitigation measure would reduce Impact WQ-4 (CP1) to a less-than-significant level.

Mitigation Measure WQ-6 (CP1): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines Reclamation will prepare and implement a plan to remove or otherwise remediate two sites related to historic mining activities that have the potential to introduce metals into Shasta

Lake, a Section 303(d)-listed water body. This plan will include requirements to coordinate with Federal, State, and local agencies and landowners to ensure that measures taken will reduce the potential for a discharge of metals into Shasta Lake. Reclamation will obtain any required permits, approvals, and authorizations before any ground-disturbing remediation activity occurs.

Implementation of this mitigation measure would reduce Impact WQ-6 (CP1) to a less-than-significant level.

Mitigation Measure WQ-7 (CP1): Implement Mitigation Measure WQ-1 (CP1) to Reduce Temporary Construction-Related Effects on the Upper Sacramento River Related to Sediment Reclamation will implement Mitigation Measure WQ-1 (CP1) as described above to reduce temporary construction-related effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-7 (CP1) to a less-than-significant level.

Mitigation Measure WQ-12 (CP1): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Upper Sacramento River Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-12 (CP1) to a less-than-significant level.

Mitigation Measure WQ-18 (CP1): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Extended Study Area Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-18 (CP1) to a less-than-significant level.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation measures are needed for Impacts WQ-2 (CP2), WQ-3 (CP2), WQ-5 (CP2), WQ-8 (CP2) through WQ-11 (CP2), WQ-13 (CP2) through WQ-17 (CP2), WQ-19a (CP2) through WQ-19j (CP2), and WQ-20 (CP2). Mitigation is provided below for the remaining impacts of CP2 on water quality.

Mitigation Measure WQ-1 (CP2): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities This mitigation measure is identical to Mitigation Measure WQ-1 (CP1). Implementation of this mitigation measure would reduce Impact WQ-1 (CP2) to a less-than-significant level.

Mitigation Measure WQ-4 (CP2): Implement Mitigation Measure WQ-4 (CP1) to Reduce Long-Term Effects on Shasta Lake and Its Tributaries

Related to Sediment Reclamation will implement Mitigation Measure WQ-4 (CP1) as described above to reduce long-term effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-4 (CP2) to a less-than-significant level.

Mitigation Measure WQ-6 (CP2): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines This mitigation measure is identical to Mitigation Measure WQ-6 (CP1). Implementation of this mitigation measure would reduce Impact WQ-6 (CP2) to a less-than-significant level.

Mitigation Measure WQ-7 (CP2): Implement Mitigation Measure WQ-1 (CP1) to Reduce Temporary Construction-Related Effects on the Upper Sacramento River Related to Sediment Reclamation will implement Mitigation Measure WQ-1 (CP1) as described above to reduce temporary construction-related effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-7 (CP2) to a less-than-significant level.

Mitigation Measure WQ-12 (CP2): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Upper Sacramento River Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-12 (CP2) to a less-than-significant level.

Mitigation Measure WQ-18 (CP2): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Extended Study Area Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-18 (CP2) to a less-than-significant level.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

No mitigation measures are needed for Impacts WQ-2 (CP3), WQ-3 (CP3), WQ-5 (CP3), WQ-8 (CP3) through WQ-11 (CP3), WQ-13 (CP3) through WQ-17 (CP3), WQ-19a (CP3) through WQ-19j (CP3), and WQ-20 (CP3). Mitigation is provided below for the remaining impacts of CP3 on water quality.

Mitigation Measure WQ-1 (CP3): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities This mitigation measure is identical to Mitigation Measure WQ-1 (CP1). Implementation of this mitigation measure would reduce Impact WQ-1 (CP3) to a less-than-significant level.

Mitigation Measure WQ-4 (CP3): Implement Mitigation Measure WQ-4 (CP1) to Reduce Long-Term Effects on Shasta Lake and Its Tributaries Related to Sediment Reclamation will implement Mitigation Measure WQ-4 (CP1) as described above to reduce long-term effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-4 (CP3) to a less-than-significant level.

Mitigation Measure WQ-6 (CP3): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines This mitigation measure is identical to Mitigation Measure WQ-6 (CP1). Implementation of this mitigation measure would reduce Impact WQ-6 (CP3) to a less-than-significant level.

Mitigation Measure WQ-7 (CP3): Implement Mitigation Measure WQ-1 (CP1) to Reduce Temporary Construction-Related Effects on the Upper Sacramento River Related to Sediment Reclamation will implement Mitigation Measure WQ-1 (CP1) as described above to reduce temporary construction-related effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-7 (CP3) to a less-than-significant level.

Mitigation Measure WQ-12 (CP3): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Upper Sacramento River Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-12 (CP3) to a less-than-significant level.

Mitigation Measure WQ-18 (CP3): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Extended Study Area Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-18 (CP3) to a less-than-significant level.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation measures are needed for Impacts WQ-2 (CP4), WQ-3 (CP4), WQ-5 (CP4), WQ-8 (CP4) through WQ-11 (CP4), WQ-13 (CP4) through WQ-17 (CP4), WQ-19a (CP4) through WQ-19j (CP4), and WQ-20 (CP4). Mitigation is provided below for the remaining impacts of CP4 on water quality.

Mitigation Measure WQ-1 (CP4): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities This mitigation measure is identical to

Mitigation Measure WQ-1 (CP1). Implementation of this mitigation measure would reduce Impact WQ-1 (CP4) to a less-than-significant level.

Mitigation Measure WQ-4 (CP4): Implement Mitigation Measure WQ-4 (CP1) to Reduce Long-Term Effects on Shasta Lake and Its Tributaries Related to Sediment Reclamation will implement Mitigation Measure WQ-4 (CP1) as described above to reduce long-term effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-4 (CP4) to a less-than-significant level.

Mitigation Measure WQ-6 (CP4): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines This mitigation measure is identical to Mitigation Measure WQ-6 (CP1). Implementation of this mitigation measure would reduce Impact WQ-6 (CP4) to a less-than-significant level.

Mitigation Measure WQ-7 (CP4): Implement Mitigation Measure WQ-1 (CP1) and Gravel Augmentation BMPs to Reduce Temporary Construction-Related Effects on the Upper Sacramento River Related to Sediment Reclamation will implement (a) Mitigation Measure WQ-1 (CP1) as described above; and (b) specific BMPs for the gravel augmentation program. Gravel augmentation BMPs will include, but will not be limited to:

- **Construction Work Windows –** All gravel augmentation construction activities will be conducted outside of the flood season (e.g., June 15 to September 15).

- **Source and Handle Gravel So As to Minimize Potential Water Quality Impacts –** Gravel will be sorted and transported in a manner that minimizes potential water quality impacts (e.g., management of fine sediments). Gravel will be washed at least once and have a cleanliness value of 85 or higher based on Caltrans Test No. 227. Gravel will also be completely free of oils, clay, debris, and organic material.

- **Minimize Potential Impacts Associated with Equipment Contaminants –** For in-river work, all equipment will be steam cleaned every day to remove hazardous materials before the equipment enters the water.

- **Implement Feasible Spill Prevention and Hazardous Materials Management –** The accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels will be prevented to the extent feasible. Spill prevention kits will always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations). Feasible measures will be implemented to ensure that hazardous materials are properly handled and the quality of aquatic resources is protected by all reasonable means. No fueling will be done within the ordinary high-water mark or immediate floodplain, unless equipment stationed in these locations is not readily relocated (i.e., pumps, generators). For stationary equipment that must be fueled on site, containments will be provided in such a manner that any accidental spill of fuel will not be able to enter the water or contaminate sediments that may come in contact with water. Any equipment that is readily moved out of the channel will not be fueled in the channel or immediate floodplain. All fueling done at the construction site will provide containment to the degree that any spill will be unable to enter the channel or damage wetland or riparian vegetation. No equipment servicing will be done within the ordinary high-water mark or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated (i.e., pumps, generators). Additional BMPs designed to avoid spills from construction equipment and subsequent contamination of waterways will also be implemented.

- **Minimize Potential Impacts Associated with Access and Staging –** Existing access roads will be used. Equipment staging areas will be located outside of the ordinary high-water mark and away from sensitive resources.

- **Remove Temporary Fills as Appropriate –** Temporary fill, such as for access, side channel diversions, and/or side channel cofferdams, will be completely removed upon the completion of construction.

Implementation of this mitigation measure would reduce Impact WQ-1 (CP4) to a less-than-significant level.

Mitigation Measure WQ-12 (CP4): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Upper Sacramento River Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-12 (CP4) to a less-than-significant level.

Mitigation Measure WQ-18 (CP4): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Extended Study Area Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-18 (CP4) to a less-than-significant level.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation measures are needed for Impacts WQ-2 (CP5), WQ-3 (CP5), WQ-5 (CP5), WQ-8 (CP5) through WQ-11 (CP5), WQ-13 (CP5) through WQ-17 (CP5), WQ-19a (CP5) through WQ-19j (CP5), and WQ-20 (CP5).

Mitigation is provided below for the remaining impacts of CP5 on water quality.

Mitigation Measure WQ-1 (CP5): Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Comply with Applicable Federal Regulations Concerning Construction Activities This mitigation measure is identical to Mitigation Measure WQ-1 (CP1). Implementation of this mitigation measure would reduce Impact WQ-1 (CP5) to a less-than-significant level.

Mitigation Measure WQ-4 (CP5): Implement Mitigation Measure WQ-4 (CP1) to Reduce Long-Term Effects on Shasta Lake and Its Tributaries Related to Sediment Reclamation will implement Mitigation Measure WQ-4 (CP1) as described above to reduce long-term effects related to sediment. Implementation of this mitigation measure would reduce Impact WQ-4 (CP5) to a less-than-significant level.

Mitigation Measure WQ-6 (CP5): Prepare and Implement a Site-Specific Remediation Plan for Historic Mine Features Subject to Inundation in the Vicinity of the Bully Hill and Rising Star Mines This mitigation measure is identical to Mitigation Measure WQ-6 (CP1). Implementation of this mitigation measure would reduce Impact WQ-6 (CP5) to a less-than-significant level.

Mitigation Measure WQ-7 (CP5): Implement Mitigation Measure WQ-1 (CP1) and Gravel Augmentation BMPs to Reduce Temporary Construction-Related Effects on the Upper Sacramento River Related to Sediment This mitigation measure is identical to Mitigation Measure WQ-7 (CP4). Implementation of this mitigation measure would reduce Impact WQ-7 (CP5) to a less-than-significant level.

Mitigation Measure WQ-12 (CP5): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Upper Sacramento River Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-12 (CP5) to a less-than-significant level.

Mitigation Measure WQ-18 (CP5): Implement Mitigation Measure WQ-6 (CP1) to Reduce Long-Term Metals Effects on the Extended Study Area Reclamation will implement Mitigation Measure WQ-6 (CP1) as described above to reduce long-term metals effects. Implementation of this mitigation measure would reduce Impact WQ-18 (CP5) to a less-than-significant level.

7.3.6 Cumulative Effects

Chapter 3, "Considerations for Describing the Affected Environment and Environmental Consequences" discusses the overall methodology for cumulative impacts of the project alternatives, including the relationship to the

CALFED programmatic cumulative impacts analysis, qualitative and quantitative assessment, past and future actions in the primary and extended study areas, and significance criteria.

This section analyzes the overall cumulative impacts of the project alternatives with other past, present, and reasonably foreseeable future projects that would produce related impacts.

The projects listed in the quantitative analysis section of Chapter 3, “Considerations for Describing the Affected Environment and Environmental Consequences” are included in the 2030 level of development alternatives above. Accordingly, quantitative effects of the projects combined with the SLWRI alternatives are described in the Section 7.3, “Environmental Consequences and Mitigation Measures.” The discussion below focuses on the qualitative effect of the SLWRI alternatives and the other past, present, and reasonably foreseeable future projects.

Because of the substantial degradation in water quality in the primary and extended study areas when considering past, present, and reasonably foreseeable projects, and as identified in the existing conditions presented in this chapter, a significant cumulative impact would occur on water quality overall under both existing and future conditions. These cumulative impacts are occurring without the proposed action. Several factors could substantially affect water quality in both the primary and extended study areas as an outcome of reasonably foreseeable future actions, but the potential effects are highly uncertain and may result in either a beneficial or adverse impact on water quality in the study areas.

The effect of climate change on operations at Shasta Lake could potentially result in changes to water quality. As described in the Climate Change Projection Appendix, climate change could result in higher inflows to Shasta Lake in the winter and early spring due to a shift from precipitation falling as snow to rain. This change could result in both higher Shasta Lake releases in the winter and spring to manage the increased potential for flood events, and an increase in water temperature for Shasta Lake inflows. A corresponding decrease in Shasta Lake releases in the summer and fall and a decrease in operable cold-water volume could result in warmer flows downstream.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 would not result in adverse changes to sediment, metals, and temperature, and therefore would not make a cumulatively considerable incremental contribution to an overall significant cumulative impact on water quality.

Without mitigation, CP1 could cause potentially significant effects on water quality in the primary study area. These effects could be caused temporarily or for the short term by construction-related activities that cause sediment, petroleum, or other substances to enter waterways in runoff. Mitigation measures would eliminate these effects or reduce them to a less-than-significant level.

CP1 would also affect water quality by increasing the volume of water in the reservoir and by altering downstream river flows. The effects on water quality resulting from these hydrologic alterations would be long term and much greater than the temporary and short-term effects related to construction.

Hydrologic modeling output predicts that hydrologically, CP1 would result in a small change in reservoir storage and minimal change in river flows relative to the No-Action Alternative. A small increase in the volume of water stored in the reservoir under CP1 could result in additional inputs of metals from shoreline erosion of historical mining deposits and would result in a slight dilution of inputs of sediment and metals relative to existing and future No-Action conditions. The potential for additional inputs of metals would be substantially reduced or eliminated by Mitigation Measure WQ-6 (CP1). Changes in Sacramento River flows can be best characterized as a small decrease in monthly average winter and early spring flows in some years as measured below Keswick Dam, RBPP, Wilkins Slough, and Freeport, and a slight increase in summer flows in most years. This redistribution of flows would have little effect on water quality as measured by metals, sediment, salinity, and temperature.

The small reduction in winter flows caused by CP1 would slightly reduce potential sediment loading and discharge rates, and would also slightly reduce transport of heavy metals. Therefore, the water quality impact of CP1 related to metals and sediment would not be adverse.

Monthly mean water temperatures at all modeling locations (below Shasta Dam, below Keswick Dam, above Bend Bridge, and above Red Bluff) within the upper Sacramento River under CP1 would be essentially equivalent or slightly decreased (i.e., beneficial). Therefore, the effects of CP1 on water quality measured as water temperature would be beneficial, not adverse.

Implementing Mitigation Measure WQ-1 (CP1) would eliminate adverse effects from CP1, and the incremental contribution of CP1 to cumulative effects on water quality would no longer be cumulatively considerable. In summary, effects of CP1 on water quality measured as water temperature, metals, and sediment would be less than significant, and CP1 would not cause an incremental cumulatively considerable contribution to an overall significant cumulative impact on water quality in the primary study area.

In the extended study area, CP1 could also influence water quality in the Delta by altering the quality, volume, or timing of Sacramento River flows. However, because changes in Sacramento River flows relative to the No-Action Alternative would be minimal and effects would diminish with distance from

Shasta Dam, the effects would be very minor. (Water quality effects are attenuated by multiple factors, including flow from tributaries, stormwater runoff, and municipal and agricultural discharges.) Furthermore, the Central Valley's reservoirs and diversions are managed as a single integrated system, and the guidelines for this system, which are described in the CVP OCAP, have been designed to maintain standards for Delta inflow and water quality. Therefore, water quality impacts of CP1 at the Delta would not make a cumulatively considerable incremental contribution to the overall significant cumulative impact on Delta water quality.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased releases with potentially increased water temperatures at other times. The additional storage associated with CP1 could potentially reduce these effects, allowing Shasta Lake to capture some of the increased runoff in the winter and early spring for both cold-water storage and release in summer and fall. This would benefit both Sacramento River water temperatures and Delta water quality. Potential impacts associated with Sacramento River water temperatures and Delta water quality would be less than significant under CP1. Therefore, even with the addition of anticipated effects of climate change, CP1 would not have a significant cumulative effect, and could be potentially beneficial.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

The cumulative effects of CP2 would be similar to those of CP1, except that the greater increase in reservoir storage and river flow alteration under CP2 would result in greater beneficial effects on water temperature in the upper Sacramento River. Effects on sediments and metals in the Upper Sacramento River, and on Delta water quality would be effectively the same as CP1. Therefore, water quality impacts of CP2 would not make a cumulatively considerable incremental contribution to the overall significant cumulative water quality impact in the primary study area or extended study area, including the Delta.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased releases with potentially increased water temperatures at other times. The additional storage associated with CP2 could potentially reduce these effects, allowing Shasta Lake to capture some of the increased runoff in the winter and early spring for both cold-water storage and release in summer and fall. This would benefit both Sacramento River water temperatures and Delta water quality. Potential impacts associated with Sacramento River water temperatures and Delta water quality would be less than significant under CP2. Therefore, even with the addition of anticipated effects of climate change, CP2 would not have a significant cumulative effect, and could be potentially beneficial.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

The cumulative effects of CP3 would be similar to those of CP1 and CP2, except that the greater increase in reservoir storage and river flow alteration under CP3 would result in greater beneficial effects on water temperature in the upper Sacramento River. Effects on sediments and metals in the Upper Sacramento River, and on Delta water quality would be effectively the same as CP1. Therefore, water quality impacts of CP3 would not make a cumulatively considerable incremental contribution to the overall significant cumulative water quality impact in the primary study area or extended study area, including the Delta.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased releases with potentially increased water temperatures at other times. The additional storage associated with CP3 could potentially reduce these effects, allowing Shasta Lake to capture some of the increased runoff in the winter and early spring for both cold-water storage and release in summer and fall. This would benefit both Sacramento River water temperatures and Delta water quality. Potential impacts associated with Sacramento River water temperatures and Delta water quality would be less than significant under CP3. Therefore, even with the addition of anticipated effects of climate change, CP3 would not have a significant cumulative effect, and could be potentially beneficial.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

With the exception of water quality measured as water temperature, the cumulative effects of CP4 would be the same as those of CP1. Effects of CP4 on water quality measured as water temperature would be beneficial and greater than those of other alternatives.

Therefore, water quality impacts of CP4 would not make a cumulatively considerable incremental contribution to the overall significant cumulative water quality impact in the primary study area or extended study area, including the Delta.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased releases with potentially increased water temperatures at other times. The additional storage associated with CP4 could potentially reduce these effects, allowing Shasta Lake to capture some of the increased runoff in the winter and early spring for both cold-water storage and release in summer and fall. This would benefit both Sacramento River water temperatures and Delta water quality. Potential impacts associated with Sacramento River water temperatures and Delta water quality would be less than significant under CP4. Therefore, even with the addition of anticipated effects of climate change, CP4 would not have a significant cumulative effect, and could be potentially beneficial.

CP5 – 18.5-Foot Dam Raise, Combination Plan

With the exception of water quality measured as water temperature, the cumulative effects of CP5 would be the same as those of CP1. Effects of CP5 on water quality measured as water temperature would be beneficial and effectively the same as CP3. Therefore, water quality impacts of CP5 would not make a cumulatively considerable incremental contribution to the overall significant cumulative water quality impact in the primary study area or extended study area, including the Delta.

As stated previously, effects of climate change on operations of Shasta Lake could include increased inflows and releases at certain times of the year, and decreased releases with potentially increased water temperatures at other times. The additional storage associated with CP5 could potentially reduce these effects, allowing Shasta Lake to capture some of the increased runoff in the winter and early spring for both cold-water storage and release in summer and fall. This would benefit both Sacramento River water temperatures and Delta water quality. Potential impacts associated with Sacramento River water temperatures and Delta water quality would be less than significant under CP5. Therefore, even with the addition of anticipated effects of climate change, CP5 would not have a significant cumulative effect, and could be potentially beneficial.

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Chapter 8
Noise and Vibration

8.1 Affected Environment

This section describes the affected environment related to noise and vibration for the dam and reservoir modifications proposed under SLWRI action alternatives.

8.1.1 Acoustic Fundamentals

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound, as described in more detail below, is an audible vibration of an elastic medium.

Sound Properties

A sound wave is introduced into a medium (e.g., air) by a vibrating object. The vibrating object (e.g., vocal cords, the string and sound board of a guitar, or the diaphragm of a radio speaker) is the source of the disturbance that sets the medium to vibrate and then propagates through the medium. Regardless of the type of source creating the sound wave, the particles of the medium through which the sound moves are vibrating in a back-and-forth motion at a given frequency, tone, or pitch. The frequency of a wave refers to how often the particles vibrate when a wave passes through the medium. Wave frequency is measured as the number of complete back-and-forth vibrations of a particle per unit of time. If a particle of air undergoes 1,000 longitudinal vibrations in 2 seconds, then the frequency of the wave would be 500 vibrations per second. A commonly used unit for frequency is Hertz (Hz).

Each particle vibrates as a result of the motion of its nearest neighbor. For example, the first particle of the medium begins vibrating at 500 Hz and sets the second particle of the medium into motion at the same frequency (500 Hz). The second particle begins vibrating at 500 Hz and thus sets the third particle into motion at 500 Hz. The process continues throughout the medium; hence each particle vibrates at the same frequency, which is the frequency of the original source. Subsequently, a guitar string vibrating at 500 Hz will set the air particles in the room vibrating at the same frequency (500 Hz), which carries a sound signal to the ear of a listener that is detected as a 500-Hz sound wave.

The back-and-forth vibration motion of the particles of the medium would not be the only observable phenomenon occurring at a given frequency. Because a sound wave is a pressure wave, a detector could be used to detect oscillations in pressure from high to low and back to high pressure. As the compression (high-pressure points) and rarefaction (low-pressure points) disturbances move through the medium, they would reach the detector at a given frequency. For example, a compression would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Similarly, a rarefaction would reach the detector 500 times per second if the frequency of the wave were 500 Hz. Thus, the frequency of a sound wave refers not only to the number of back-and-forth vibrations of the particles per unit of time but also to the number of compression or rarefaction disturbances that pass a given point per unit of time. A detector could be used to detect the frequency of these pressure oscillations over a given period of time. The period of the sound wave can be found by measuring the time between successive compressions or the time between successive rarefactions. The frequency is simply the reciprocal of the period; thus an inverse relationship exists so that as frequency increases, the period decreases, and vice versa.

A wave is a disturbance through some medium (e.g., air, water, space) that typically transfers energy. Waves travel and transfer energy from one point to another, often with little or no permanent displacement of the particles of the medium. For example, in an ocean wave, the seawater appears to be move along the path of the wave. However, the water particles themselves are nearly stationary—it is the energy transferred through those particles (the wave) causing displacement that makes it appear that the water itself is moving.

In the case of sound (and noise), the “wave” is a vibration or disturbance moving through air particles and, at a certain range of frequencies, is audible to the human ear. The amount of energy carried by a wave is related to the amplitude (loudness) of the wave. A high-energy wave is characterized by high amplitude; a low-energy wave is characterized by low amplitude. The amplitude of a wave refers to the maximum amount of displacement of a particle from its rest position. The energy transported by a wave is directly proportional to the square of the amplitude of the wave. This means that a doubling of the amplitude of a wave indicates a quadrupling of the energy transported by the wave.

Sound and the Human Ear

Because of the ability of the human ear to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). The sound-pressure level in decibels is calculated by taking the log of the ratio between the actual sound pressure and the reference sound pressure squared. The reference sound pressure is considered the absolute hearing threshold (Caltrans 1998). Use of this logarithmic scale reveals that the total sound from two individual sources of 65 A-weighted decibels (dBA) each (see explanation of the A-weighting scale below) is 68 dBA, not 130 dBA; that is, doubling the source strength increases the sound pressure by 3 dBA.

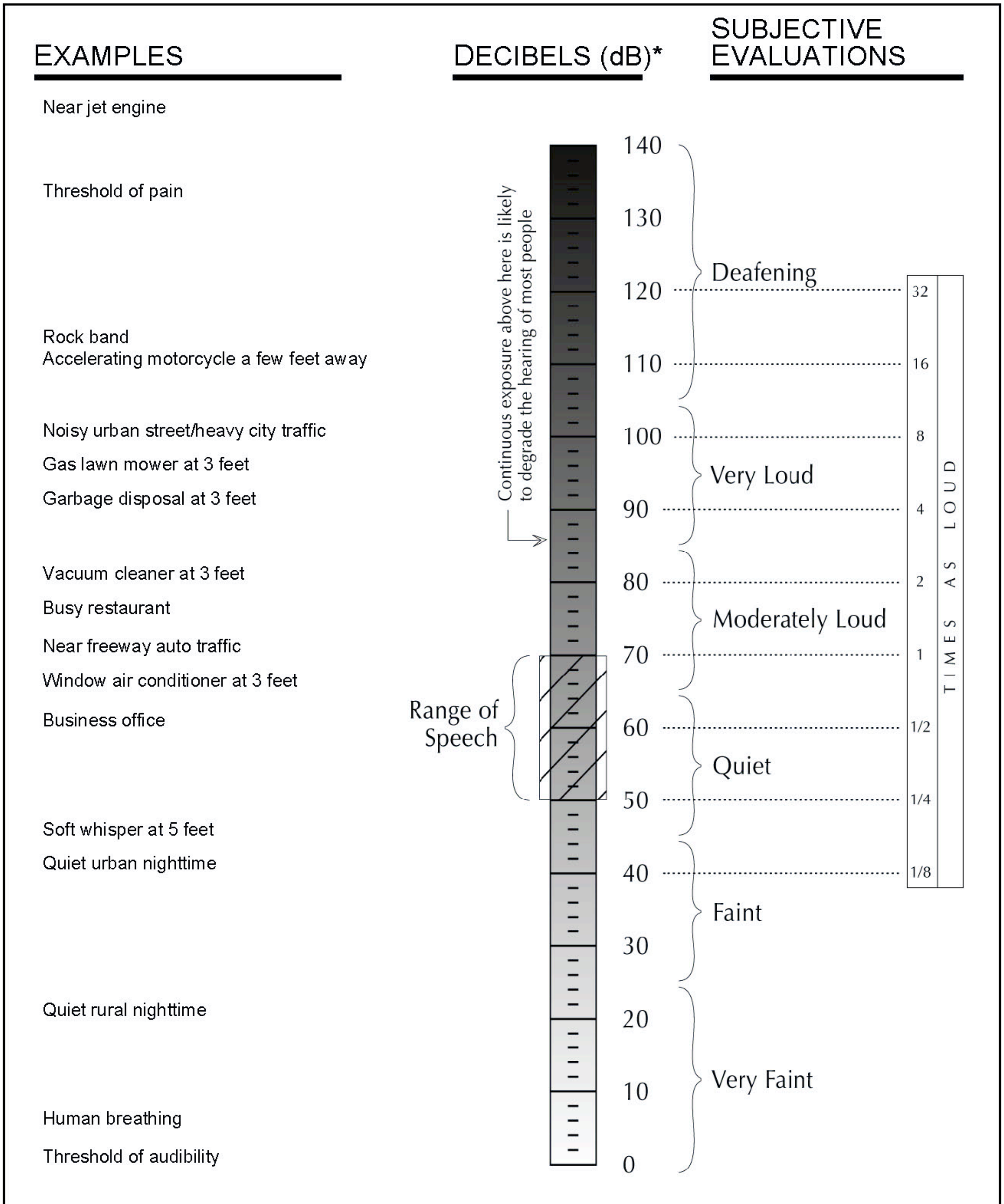
The human ear is sensitive to frequencies from 20 Hz to 20,000 Hz (the audible range) and can detect the vibration amplitudes that are comparable in size to a hydrogen atom (EPA 1974). When damaged by noise, the ear is typically affected at the 4,000-Hz frequency first; therefore, this can be considered the most noise-sensitive frequency. The averaged frequencies of 500 Hz, 1,000 Hz, and 2,000 Hz have traditionally been employed in hearing conservation criteria because of their importance to the hearing of speech sounds (ASA 1997).

The human ear is not equally sensitive to all sound frequencies, depending on the amplitude of the sound; therefore, a specific frequency-dependent rating scale was devised to relate noise to human sensitivity. This called the weighting scale or function. The A-weighting scale is the most commonly used and is noted as A-weighted dB, dB(A), or dBA. The dBA scale discriminates against frequencies in a manner approximating the sensitivity of the human ear when a source is at 50 dB. The basis for compensation is a comparison of the "loudness" of tones played one at a time with a reference tone producing 50 dB. This dBA scale has been chosen by most authorities for the purpose of regulating environmental noise. Typical indoor and outdoor noise levels are presented on Figure 8-1.

With respect to how humans perceive increases in noise levels, for pure tones or some broadband tones, a 1-dBA increase is imperceptible, a 3-dBA increase is barely perceptible, a 6-dBA increase is clearly perceptible, and a 10-dBA increase is subjectively perceived as approximately twice as loud (Egan 1988). For this reason, an increase of 3 dBA or more is generally considered a degradation of the existing noise environment for this type of source. For more complex sources, that is, where the tones differ substantially between sources, such as for the sound of a heavy truck versus a new car or a kitchen blender, the ear perceives differences much more quickly.

Sound Propagation

As sound (noise) propagates from the source to the receptor, the attenuation, or manner of noise reduction in relation to distance, depends on surface characteristics, atmospheric conditions, and the presence of physical barriers. The inverse-square law describes the attenuation when sound travels from a point source such as an air-conditioning unit to the receptor. Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA per doubling of distance (dBA/DD). However, from a line source, such as a long line of traffic on a freeway, sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. The surface characteristics between the source and the receptor may result in additional sound absorption and/or reflection. Atmospheric conditions such as wind speed, temperature, and humidity may affect noise levels. Furthermore, the presence of a barrier between the source and the receptor may also attenuate noise levels. The actual amount of attenuation depends on the size of the barrier and the frequency of the noise. A noise barrier may be any natural or human-made feature such as a hill, building, wall, or berm (Caltrans 1998).



* dB are "average" values as measured on the A-scale of a sound-level meter.
From Concepts in Architectural Acoustics: M. David Egan, McGraw Hill, 1972 and U.S. Department of Housing and Urban Development, Office of Community Planning and Development "The Noise Guidebook."

Figure 8-1. Typical Noise Levels

Noise Descriptors

The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often encountered when dealing with traffic, community, and environmental noise are defined below (Caltrans 1998; Lipscomb and Taylor 1978):

- **L_{max} (maximum noise level) –** The maximum noise level during a specific period of time. The L_{max} may also be referred to as the "highest (noise) level."
- **L_{min} (minimum noise level) –** The minimum noise level during a specific period of time.
- **L_x (statistical descriptor) –** The noise level exceeded X percent of a specific period of time.
- **L_{eq} (equivalent noise level) –** The energy mean (average) noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}.
- **L_{dn} (day-night noise level) –** The 24-hour L_{eq} with a 10-dBA "penalty" for the noise-sensitive hours between 10 p.m. and 7 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.
- **CNEL (community noise equivalent level) –** A noise level similar to the L_{dn} described above, but with an additional 5-dBA "penalty" for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If the same 24-hour noise data are used, the CNEL is typically approximately 0.5 dBA higher than the L_{dn}.
- **SEL (single-event (impulsive) noise level) –** A receiver's cumulative noise exposure from a single impulsive-noise event, which is defined as an acoustical event of short duration and which involves a change in sound pressure above some reference value.

Negative Effects of Noise on Humans

Negative effects of noise exposure include physical damage to the human auditory system, speech interference, sleep interference, activity interference, and disease. Exposure to noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. However, gradual and traumatic hearing loss both may result in permanent hearing damage. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise, and the exposure time (Caltrans 1998).

Vibration Fundamentals

Vibration is sound radiated through the ground. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. Sources of groundborne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, and landslides) and human-made causes (e.g., explosions, machinery, traffic, trains, and construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, groundborne vibrations may be described by amplitude and frequency.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or root mean squared (RMS), as in RMS vibration velocity. The PPV and RMS velocity are normally described in inches per second (in/sec). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (FTA 2006; Caltrans 2002a).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a 1-second period. As with airborne sound, the RMS velocity is often expressed in decibel notation, expressed as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA 2006).

The background vibration-velocity level in residential areas is usually approximately 50 VdB. Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels (FTA 2006).

Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Construction activities can generate groundborne vibrations, which can pose a risk to nearby structures. Constant or transient vibrations can weaken structures, crack facades, and disturb occupants (FTA 2006).

Construction vibrations can be transient, random, or continuous. Transient construction vibrations are generated by blasting, impact pile driving, and wrecking balls. Continuous vibrations result from vibratory pile drivers, large pumps, and compressors. Random vibration can result from jackhammers, pavement breakers, and heavy construction equipment. Table 8-1 describes the general human response to different levels of groundborne vibration-velocity levels.

Table 8-1. Human Response to Different Levels of Groundborne Noise and Vibration

Vibration-Velocity Level	Human Reaction
65 VdB	Approximate threshold of perception.
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85 VdB	Vibration acceptable only if there are an infrequent number of events per day.

Source: FTA 2006

Key:
VdB = vibration decibels

8.1.2 Existing Noise Sources and Levels

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Existing sources of noise and vibration in the primary study area associated with roadway traffic and aircraft noise are outlined below. Noise is also generated by watercraft on Shasta Lake and stationary noise sources such as mechanical equipment at the existing dam facility. Additional sites that would be affected by the project are existing bridges, roads, and structures that would be inundated with implementation of the proposed dam rise and would need to be modified, demolished, or reconstructed. Sensitive receptors in these areas consist of residences, transient lodging, and recreational facilities.

Roadway Traffic Interstate 5 (I-5) and State Routes 36, 44, 151, 273, and 299 contribute the majority of roadway noise in the greater Shasta area. The Federal Highway Administration's Highway Traffic Noise Prediction Model was used to predict existing traffic noise levels for these routes. Table 8-2 shows existing average daily traffic volumes for Shasta County's major roadways, modeled vehicle distribution characteristics, and the modeled distance from the roadway centerline to the various noise-level contours for each affected roadway segment in the study area under existing conditions. The modeling presented was based on 2006 traffic data from California Department of Transportation (Caltrans). These data are also representative of current information from Caltrans (Caltrans 2012) that show minor fluctuations in overall traffic volumes. The traffic noise levels shown in the table assume no shielding or reflection from structures or topography. Actual noise levels would vary from day to day.

Railway Traffic in Shasta County is served by the Union Pacific Railroad single-track main line, which travels north/south through the primary study area, paralleling I-5. (The McCloud Railway Company, a single-track short line, runs from McCloud to Burney, but because its activity is limited, noise measurements were not conducted for this line.) Noise measurements were conducted at two sites near Redding and Cottonwood for the *Shasta County General Plan* Noise Element. Table 8-3 presents noise levels associated with railroad noise in the Shasta Lake area.

Aircraft The three existing airports in the primary study area are described below.

Redding Municipal Airport In the 12-month period ending April 2012, there were approximately 104,674 total aircraft operations at Redding Municipal Airport (FAA 2012). As shown in the background report for the *Shasta County General Plan* Noise Element, the 65-dB CNEL contour is confined primarily to the airport property. The 60-dB CNEL contour extends outside of the property, but does not encroach on existing residential uses. According to the *Redding Municipal Airport Master Plan*, aviation growth at the airport will affect the surrounding area. The total number of aircraft operations is estimated to increase to 162,400 by 2015.

Fall River Mills Airport In 2001, there were approximately 6,000 total aircraft operations at Fall River Mills Airport. Based on the *Environmental Assessment for the Fall River Mills Airport Layout Plan* (April 2003), the existing 65-dB CNEL contour is contained within the existing airport boundary. Aviation growth at Fall River Mills Airport can also affect the area surrounding the airport. The number of aircraft operations is expected to increase to 15,000 by 2021. The future (2021) 65-dB CNEL contour is confined to Public Facility and Agriculture lands. The 60-dB CNEL contour also encompasses Urban Residential lands.

Table 8-2. Summary of Modeled Existing Traffic Noise Levels (Year 2006)*

Roadway Segment	Modeling Assumptions				Distance (feet) from Roadway Edge to CNEL/L_{dn} (dBA)[1]				CNEL/L_{dn} (dBA) from Roadway Edge
	Average Daily Traffic Volume	Speed (mph)	Traffic Distribution Percentages (%)		70 CNEL	65 CNEL	60 CNEL	55 CNEL	50 Feet
			Auto/Medium Truck/Heavy Truck	Day/ Evening/ Night					
SR 36, north of Red Bluff	12,000	45	79/9/12	79/11/10	64	138	298	641	72
SR 44, junction with I-5	51,000	65	81/9/10	79/11/10	235	507	1,093	2354	80
SR 151, Shasta Lake	5,500	45	81/9/10	79/11/10	36	77	165	356	68
SR 273, Redding	23,800	35	81/9/10	79/11/10	74	160	345	742	73
SR 299, Redding	19,900	35	81/9/10	79/11/10	66	142	306	659	72
I-5, Bridgebay	27,500	70	81/9/10	79/11/10	171	368	792	1,706	78
I-5, Shasta Lake	37,000	70	81/9/10	79/11/10	208	448	965	2,080	79
I-5, Redding	67,000	70	81/9/10	79/11/10	309	666	1,434	3,090	82
I-5, Anderson	50,000	70	81/9/10	79/11/10	254	548	1,180	2,542	81
I-5, Cottonwood	46,500	70	81/9/10	79/11/10	242	522	1,124	2,422	80
I-5, Red Bluff	40,500	70	79/9/12	79/11/10	231	498	1,073	2,313	80

Source: Average daily traffic volumes from CalTrans (2006). Modeling performed by EDAW (now AECOM) in 2007

** 2006 and 2012 traffic volumes modeled on these roadways produce the same levels of noise.*

Key:
CalTrans = California Department of Transportation
CNEL = community noise equivalent level
dBA = A-weighted decibels
I-5 = Interstate 5
L_{dn} = day-night noise level
mph = miles per hour
SR = State Route

Table 8-3. Approximate Distance to Union Pacific Railroad Noise Contours

Ldn, Based on Distance from Railroad Tracks				Distance to Ldn Contour (feet)			
At 50 Feet		At 100 Feet		60 dB		65 dB	
Existing	Future	Existing	Future	Existing	Future	Existing	Future
South of Bonnyview Road				**South of Bonnyview Road**			
69.5 dB	70.8 dB	65.0 dB	66.3 dB	215	262	100	122
Cottonwood				**Cottonwood**			
76.0 dB	77.3 dB	71.5 dB	72.8 dB	580	711	269	330

Source: Shasta County 2004
Key:
dB = decibel
L_{dn} = day-night noise level

Benton Airpark In the 12-month period ending December 2011, there were approximately 35,000 total aircraft operations at this Airpark (FAA 2012). Based on the *Benton Airpark Master Plan* (March 2005), the existing 65-dB CNEL contour is contained within the existing airport boundary. Aviation growth at Benton Airpark can also affect the area surrounding the airport. The number of aircraft operations is expected to increase to 38,000 by 2021. The future (2021) 65-dB CNEL contour is confined to airport property and vacant land.

Other Aircraft Activities In addition to the aircraft facilities listed above, helipads from medical facilities in Redding are also in use. Usage of these helipads would be reserved for emergencies and would be intermittent in comparison to usage by full-time facilities such as the Benton Airpark. In the fire season, aircraft, operated by the California Department of Forestry and Fire protection or under contract with the Forest Service, use Shasta Lake as a source of water for fighting wildfires. Fire helicopters and tankers use the lake as needed during emergencies. Because firefighting is intermittent, no consistent noise levels would result from firefighting operations.

Fixed Noise Sources Industrial, light industrial, commercial, and public service facilities that could produce objectionable noise levels at nearby noise-sensitive uses are dispersed throughout the primary study area. Among these fixed noise sources are lumber mills, auto maintenance shops, car washes, loading docks, recycling centers, electricity generating stations, landfills, and athletic fields.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Noise sources within the extended study area would be similar to the general descriptions provided for the primary study area.

8.1.3 Existing Noise-Sensitive Land Uses

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Noise-sensitive land uses (sensitive receptors) are uses where exposure to noise would result in adverse effects and uses where quiet is essential. Residential dwellings are of primary concern. Other noise-sensitive land uses are schools, hospitals, convalescent facilities, parks, hotels, places of worship, and libraries. No sensitive land uses are immediately adjacent to (within 0.5 mile of) the dam. Sensitive land uses in the proximity of the dam raise site would be the vacant on site residence at the fish hatchery approximately one-half mile downstream. The nearest occupied residence is the horse camp located approximately 7,000 feet downstream; residents on Lake Boulevard are located approximately 4,500 feet east. Other sensitive receptors would include any residences within one-half mile of other construction work being done as a result of the dam raise. Bridge construction would occur at Charlie Creek, Doney Creek, McCloud River, Pit River, Fenders Ferry, Didallas Creek, and other Union Pacific Railroad bridges. Major road construction would occur on Lakeshore Drive, in the Turntable Bay Area, on Gillman Road, in Jones Valley and the Silverthorn Area, and on Salt Creek Road. The nearest school to construction activities would be the Smithson School in Lakehead (approximately 500 feet); the nearest place of worship would be Canyon Community Church also in Lakehead (approximately 800 feet).

Lower Sacramento River and Delta and CVP/SWP Service Areas

Noise receptors within the extended study area would be similar to those generally described above for the primary study area.

8.2 Regulatory Framework

8.2.1 Federal

No Federal plans, policies, regulations, or laws related to noise are applicable to the project. The environmental review of Federal projects generally defers to State, county, or other local guidelines.

To address the human response to groundborne vibration, the Federal Transit Administration (FTA) of the U.S. Department of Transportation has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These criteria include 65 VdB for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, and laboratory facilities), 80 VdB for residential uses and buildings where people normally sleep, and 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, and offices) (FTA 2006).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics at the request of the U.S. Environmental Protection Agency (FTA 2006). For fragile structures, Committee of Hearing, Bio Acoustics, and Bio Mechanics recommends a maximum limit of 0.25 in/sec PPV (FTA 2006).

8.2.2 State

Governor's Office of Planning and Research

The Governor's Office of Planning and Research published the *State of California General Plan Guidelines* (OPR 2003), which provides guidance for the acceptability of projects within specific L_{dn} contours. Table 8-4 summarizes acceptable and unacceptable community noise exposure limits for various land use categories.

Generally, residential uses (e.g., mobile homes) are considered to be acceptable in areas where exterior noise levels do not exceed 60 dBA L_{dn}. Residential uses are normally unacceptable in areas exceeding 70 dBA L_{dn} and conditionally acceptable within 55–70 dBA L_{dn}. Schools are normally acceptable in areas up to 70 dBA L_{dn} and normally unacceptable in areas exceeding 70 dBA L_{dn}. Commercial uses are normally acceptable in areas up to 70 dBA CNEL. Between 67.5 and 77.5 dBA L_{dn}, commercial uses are conditionally acceptable, depending on the noise insulation features and the noise reduction requirements. With respect to water recreation uses, exterior noise levels that do not exceed 75 dBA CNEL/L_{dn} are considered normally acceptable, levels between 70 and 80 dBA CNEL/L_{dn} are normally unacceptable, and levels that exceed 80 dBA CNEL/L_{dn} are clearly unacceptable. The guidelines also present adjustment factors that may be used to arrive at noise-acceptability standards that reflect the noise-control goals of the community, the particular community's sensitivity to noise, and the community's assessment of the relative importance of noise issues.

California Department of Transportation

For the protection of fragile, historic, and residential structures, Caltrans recommends a threshold of 0.2 in/sec PPV for normal residential buildings and 0.08 in/sec PPV for old or historically significant structures (Caltrans 2002a). These standards are more stringent than the Federal standard established by Committee of Hearing, Bio Acoustics, and Bio Mechanics, presented above.

Table 8-4. State Noise-Compatibility Guidelines by Land-Use Category

Land-Use Category	Community Noise Exposure (CNEL/L_{dn}, dBA)			
	Normally Acceptable [a]	Conditionally Acceptable [b]	Normally Unacceptable [c]	Clearly Unacceptable [d]
Residential – Low-Density Single-Family, Duplexes, Mobile Homes	< 60	55–70	70–75	75+
Residential – Multifamily	< 65	60–70	70–75	75+
Transient Lodging – Motels, Hotels	< 65	60–70	70–80	80+
Schools, Libraries, Churches, Hospitals, Nursing Homes	< 70	60–70	70–80	80+
Auditoriums, Concert Halls, Amphitheaters		< 70	65+	
Sports Arenas, Outdoor Spectator Sports		< 75	70+	
Playgrounds, Neighborhood Parks	< 70		68–75	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	< 75		70–80	80+
Office Buildings, Businesses, Commercial and Professional	< 70	68–78	75+	
Industrial, Manufacturing, Utilities, Agriculture	< 75	70–80	75+	

Source: OPR 2003

Notes:
[a] Specified land use is satisfactory, based on the assumption that any buildings involved are of normal conventional construction, without any special noise-insulation requirements.
[b] New construction or development should be undertaken only after a detailed analysis of the noise-reduction requirements is made and needed noise-insulation features are included in the design. Conventional construction, but with closed windows and fresh-air supply systems or air conditioning, will normally suffice.
[c] New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise-reduction requirements must be made and needed noise-insulation features included in the design. Outdoor areas must be shielded.
[d] New construction or development should generally not be undertaken.

Key:
CNEL = community noise equivalent level
dBA = A-weighted decibels
L_{dn} = day-night noise level

8.2.3 Regional and Local

All major project-related construction activities would occur in Shasta County. However, haul trucks and employee trips could also occur in Tehama County and, thus, related information is also provided. In any note, the regulations provided are very similar for both.

Shasta County

Shasta County General Plan Noise Element The Noise Element of the *Shasta County General Plan* includes goals, standards, and policies designed to ensure that county residents are not subjected to noise beyond acceptable levels (Shasta County 2004). Policies that may be applicable to the project include the following:

- **Policy N-b –** Noise likely to be created by a proposed non-transportation land use shall be mitigated so as not to exceed the noise level standards of Table 8-5 as measured immediately within the property line of adjacent lands designated as noise-sensitive.

- **Policy N-c –** Where proposed non-residential land uses are likely to produce noise levels exceeding the performance standards of Table 8-5 upon existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the environmental review process so that appropriate noise mitigation may be included in the project design. The requirements for the content of an acoustical analysis are given by Table 8-5.

- **Policy N-d –** The feasibility of proposed projects with respect to existing and future transportation noise levels shall be evaluated by comparison to Tables 8-5 and 8-6.

- **Policy N-f –** Noise created by new transportation sources shall be mitigated to satisfy the levels specified in Table 8-5 at outdoor activity areas and/or interior spaces of existing noise-sensitive land uses. Transportation noise shall be compared with existing and projected noise levels.

- **Policy N-g –** Existing noise-sensitive uses may be exposed to increased noise levels due to future roadway improvement projects as a result of increased traffic capacity and volumes and increases in travel speeds. In these instances, it may not be practical to reduce increased traffic noise levels consistent with those contained in Table 8-5. Therefore, as an alternative, the following criteria may be used as a test of significance for increases in the ambient outdoor activity areas of the noise level of noise-sensitive uses created as a result of a new roadway improvement project:

  – Where existing traffic noise levels are less than 60 dB Ldn, a +5 dB Ldn increase will be considered significant,

  – Where existing traffic noise levels range between 60 and 65 dB Ldn, a +3 dB Ldn increase will be considered significant, and

– Where existing traffic noise levels are greater than 65 dB Ldn, a + 1.5 dB Ldn increase will be considered significant.

Table 8-5. Noise Level Performance Standards for New Projects Affected by or Including Nontransportation Sources

<table>
<tr><th>Noise Level Descriptor</th><th>Daytime
(7 a.m. to 10 p.m.)</th><th>Nighttime
(10 p.m. to 7 a.m.)</th></tr>
<tr><td>Hourly Leq, dB</td><td>55</td><td>50</td></tr>
<tr><td colspan="3">The noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

The County can impose noise level standards which are more restrictive than those specified above based upon determination of existing low ambient noise levels.

In rural areas where large lots exist, the exterior noise level standard shall be applied at a point 100 feet away from the residence.

Industrial, light industrial, commercial, and public service facilities which have the potential for producing objectionable noise levels at nearby noise-sensitive uses are dispersed throughout the County. Fixed-noise sources which are typically of concern include, but are not limited to, the following:</td></tr>
<tr><td colspan="2">HVAC Systems
Cooling Towers/Evaporative Condensers
Pump Stations
Lift Stations
Emergency Generators
Boilers
Steam Valves
Steam Turbines
Generators
Fans
Air Compressors</td><td>Heavy Equipment
Conveyor Systems
Transformers
Pile Drivers
Grinders
Drill Rigs
Gas or Diesel Motors
Welders
Cutting Equipment
Outdoor Speakers
Blowers</td></tr>
</table>

Source: Shasta County 2004

Notes:

The types of uses which may typically produce the noise sources described above include, but are not limited to: industrial facilities including lumber mills, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, public works projects, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.

For the purposes of the Noise Element, transportation noise sources are defined as traffic on public roadways, railroad line operations, and aircraft in flight. Control of noise from these sources is preempted by Federal and State regulations. Other noise sources are presumed to be subject to local regulations, such as a noise control ordinance. Non-transportation noise sources may include industrial operations, outdoor recreation facilities, heating, ventilation, and air conditioning units, loading docks, etc.

Key:
County = Shasta County
dB = decibels
HVAC = heating, ventilation, and air conditioning
L_{eq} = equivalent noise level

Table 8-6. Requirements for an Acoustical Analysis

An acoustical analysis prepared pursuant to the Noise Element shall:
A. Be the financial responsibility of the applicant.
B. Be prepared by a qualified person experienced in the fields of environmental noise assessment and architectural acoustics.
C. Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions and the predominant noise sources.
D. Estimate existing and projected cumulative (20 years) noise levels in terms of Ldn or CNEL and/or the standards of Table [8-5], and compare those levels to the adopted policies of the Noise Element.
E. Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element, giving preference to proper site planning and design over mitigation measures which require the construction of noise barriers or structural modifications to buildings which contain noise-sensitive land uses.
F. Estimate noise exposure after the prescribed mitigation measures have been implemented.
G. Describe a post-project assessment program which could be used to evaluate the effectiveness of the proposed mitigation measures.

Source: Shasta County 2004
Key:
CNEL = community noise equivalent level
L_{dn} = day-night noise level

- **Policy N-i –** Where noise mitigation measures are required to achieve the standards of Tables 8-5 and 8-6, the emphasis of such measures shall be placed upon site planning and project design. The use of noise barriers shall be considered a means of achieving compliance with the noise standards only after all other practical design-related noise mitigation measures have been integrated into the project.

- **Policy N-j –** Encourage railroad officials to install noise-mitigation features on trains, equipment, and at fixed-based facilities whenever possible, and instruct railroad engineers to limit their use of air horns to reduce rail-related noise impacts on cities, towns, and rural community centers.

- **Policy N-k –** All County airports lacking adopted noise level contours consistent with the General Plan forecast year of 2025 should update their respective Master Plans or Comprehensive Land Use Plans to reflect aircraft operation noise levels for existing and future operations.

- **Policy N-l –** The use of site planning and building materials/design as primary methods of noise attenuation is encouraged.

- **Policy N-m –** The County should adopt noise control guidelines to assist staff and project applicants in determining the appropriate methods for reducing transportation and non-transportation generated noise.

- **Policy N-n –** The State Noise Insulation Standards (California Code of Regulations, Title 24) and Chapter 35 of the Uniform Building Code shall be enforced.

- **Policy N-o** – As the County updates the GIS mapping data base, the traffic, airport, and railroad noise contour information contained within the Background Report for the Noise Element shall be included as a part of the mapping data base. Noise contours for transportation and fixed noise sources should be periodically updated and any subsequent revisions of the data shall be incorporated into the General Plan and adopted for noise control planning purposes, as appropriate (see Tables 8-7 and 8-8).

Table 8-7. Maximum Allowable Noise Exposure Transportation Noise Sources

Land Use	Outdoor Activity Areas[a] L_{dn}/CNEL, dB	Interior Spaces	
		L_{dn}/CNEL, dB	L_{eq}, dB[b]
Residential	60 [c]	45	–
Transient Lodging	60 [d]	45	–
Hospitals, Nursing Homes	60 [c]	45	–
Theaters, Auditoriums, Music Halls	–	–	35
Churches, Meeting Halls	60 [c]	–	40
Office Buildings	–	–	45
Schools, Libraries, Museums	–	–	45
Playgrounds, Neighborhood Parks	70	–	–

Source: Shasta County 2004

Notes:

[a] Where the location of outdoor activity areas is unknown, the exterior noise level standard shall be applied to the property line of the receiving land use. Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

[b] As determined for a typical worst-case hour during periods of use.

[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn/CNEL or less using a practical application of the best-available noise reduction measures, exterior noise levels of up to 65 dB Ldn/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

[d] In the case of hotel/motel facilities or other transient lodging, outdoor activity areas such as pool areas may not be included in the project design. In these cases, only the interior noise level criterion will apply.

Key:

CNEL = community noise equivalent level

dB = decibels

L_{dn} = day-night noise level

Table 8-8. Transportation Noise–Related Land Use Compatibility Guidelines for Development in Shasta County

Land Use Category		Community Noise Exposure (L_{dn} or CNEL, dB)						
		55	60	65	70	75	80	
Residential, Theaters, Music and Meeting Halls, Churches, and Auditoriums	G.A.	X	X					
	C.A.			X	X			
	G.U.					X	X	X
Transient Lodging— Motels, Hotels, and RV Parks	G.A.	X	X					
	C.A.			X	X	X		
	G.U.						X	X
Schools, Libraries, Museums, Nursing Homes, and Child Care	G.A.	X	X					
	C.A.			X	X	X		
	G.U.						X	X
Playgrounds, Neighborhood Parks, and Amphitheaters	G.A.	X	X	X	X			
	C.A.					X		
	G.U.						X	X
Office Buildings, Business, Commercial, and Professional	G.A.	X	X	X				
	C.A.				X	X		
	G.U.						X	X
Industrial, Manufacturing, Agriculture, and Utilities	G.A.	X	X	X	X			
	C.A.					X	X	X
	G.U.							
Golf Courses, Outdoor Spectator Sports, and Riding Stables	G.A.	X	X	X	X			
	C.A.					X	X	
	G.U.							X

Source: Shasta County 2004

Notes:

G.A. = Generally Acceptable. Specified land use is satisfactory. No noise mitigation measures are required.

C.A. = Conditionally Acceptable. Use should be permitted only after careful study and inclusion of protective measures as needed to satisfy the policies of the Noise Element.

G.U. = Generally Unacceptable. Development is usually not feasible in accordance with the goals of the Noise Element.

Key:

CNEL = community noise equivalent level

dB = decibels

L_{dn} = day-night noise level

Shasta County Code The Shasta County Code has one provision related to noise:

> *13.04.170: Unnecessary Noise Prohibited. No person shall operate any aircraft in flight or on the ground in such a manner as to cause unnecessary noise as determined by applicable Federal or State or local laws and regulations. (Prior code Section 2112.)*

Tehama County

Tehama County General Plan The Noise Element of the *Tehama County General Plan* provides a basis for comprehensive local policies to control and abate environmental noise and to protect the citizens of the county from excessive noise exposure (Tehama County 2009). The fundamental goals of the Noise Element are as follows:

- **Goal N-1 –** Provide sufficient information concerning the community noise environment so that noise may be effectively considered in the land use planning process.

  – **Policy N-1.1 –** The County shall require an acoustical analysis for new projects anticipated to generate excessive noise located adjacent, or near, to noise-sensitive land uses. The acoustical analysis shall be prepared in accordance with Table 8-9, Requirements for Acoustical Analysis Prepared in Tehama County.

Table 8-9. Requirements for an Acoustical Analysis Prepared In Tehama County

An acoustical analysis prepared pursuant to the Noise Element shall:
(1) Be the responsibility of the applicant.
(2) Be prepared by qualified persons experienced in the fields of environmental noise assessment and architectural acoustics.
(3) Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions.
(4) Estimate existing and projected cumulative noise levels in terms of the standards of Tables 9-6 and 9-7 of this General Plan and compare those levels to the adopted policies of the Noise Element.
(5) Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms evaluating possible sleep disturbance.
(6) Estimate interior and exterior noise exposure after the prescribed mitigation measures have been implemented.
(7) Describe the post-project assessment program that could be used to evaluate the effectiveness of the proposed mitigation measures.

Source: Tehama County 2009

- **Goal N-2 –** Develop strategies for abating excessive noise exposure through cost-effective mitigation measures in combination with appropriate zoning to avoid incompatible land uses.

  – **Policy N-2.4 –** The County shall restrict construction activities to the hours as determined in the Countywide Noise Control Ordinance, if such an Ordinance is adopted.

    ▪ **Implementation Measure N-2.4a –** Restrict construction activities to the hours as determined by the County's Noise Control Ordinance unless an exemption is received from the County to cover special circumstances. Special circumstances may include emergency operations, short-duration construction, etc.

    ▪ **Implementation Measure N-2.4b –** Require all internal combustion engines that are used in conjunction with construction activities be muffled according to the equipment manufacturer's requirements.

- **Goal N-3 –** Protect those existing regions of the planning area whose noise environments are deemed acceptable, and also those locations throughout the community deemed "noise sensitive."

- **Goal N-4 –** Protect existing noise-producing commercial and industrial uses in Tehama County from encroachment by noise-sensitive land uses.

  - **Policy N-4.1 –** The County shall require review for discretionary industrial, commercial, or other noise-generating land uses for compatibility with adjacent and nearby noise-sensitive land uses.

  - **Policy N-4.2 –** The interior and exterior noise level standards for noise-sensitive areas of new uses affected by non-transportation noise sources within Tehama County are depicted in Table 8-10.

Lower Sacramento River and Delta

General plan noise elements and noise ordinances from all counties in the lower Sacramento River and Delta and communities in Tehama, Butte, Glenn, Colusa, Sutter, Yolo, Sacramento, Solano, and Contra Costa counties would be applicable to affected areas within their jurisdictions. The general plans and codes in these jurisdictions would be similar to the Shasta and Tehama county regulations outlined above. Construction, land use, and acceptable levels for various land uses would be defined and outlined.

CVP/SWP Service Areas

All community and county plans and ordinances in the CVP and SWP service areas would be applicable to affected areas within their jurisdictions. The general plans and codes in these jurisdictions would be similar to the Shasta and Tehama county regulations outlined above. Construction, land use, and acceptable levels for various land uses would be defined and outlined.

Table 8-10. Noise Standards for New Uses Affected By Nontransportation Noise in Tehama County

New Land Use	Outdoor Activity Area—L_{eq}, dB		Interior—L_{eq}, dB	
	Daytime	Nighttime	Day and Night	Notes
All Residential	50	45	35	1,2,7
Transient Lodging	55	–	40	3
Hospitals and Nursing Homes	50	45	35	4
Theaters and Auditoriums	–	–	35	
Churches, Meeting Halls, Schools, Libraries, etc.	55	–	40	
Office Buildings	55	–	45	5,6
Commercial Buildings	55	–	45	5,6
Playgrounds, Parks, etc.	65	–	–	6
Industry	65	65	50	5

Source: Tehama County 2009

Notes:

[1] Outdoor activity areas for single-family residential uses are defined as back yards. For large parcels or residences with no clearly defined outdoor activity area, the standard shall be applicable within a 100-foot radius of the residence.

[2] For multi-family residential uses, the exterior noise level standard shall be applied at the common outdoor recreation area, such as at pools, play areas or tennis courts. Where such areas are not provided, the standards shall be applied at individual patios and balconies of the development.

[3] Outdoor activity areas of transient lodging facilities include swimming pool and picnic areas, and are not commonly used during nighttime hours.

[4] Hospitals are often noise generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.

[5] Only the exterior spaces of these uses designated for employee or customer relaxation have any degree of sensitivity to noise.

[6] The outdoor activity areas of office, commercial and park uses are not typically utilized during nighttime hours.

[7] It may not be possible to achieve compliance with this standard at residential uses located immediately adjacent to loading dock areas of commercial uses while trucks are unloading. The daytime and nighttime noise level standards applicable to loading docks shall be 55 and 50 dB Leq, respectively.

General: The Table 9-7 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table 9-7, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.

Key:
dB = decibels
L_{eq} = equivalent noise level

8.3 Environmental Consequences and Mitigation Measures

8.3.1 Methods and Assumptions

Land use types and major noise sources in the project vicinity were identified based on existing documentation (e.g., the Shasta County Zoning Code) and site reconnaissance data. To assess potential short-term construction noise impacts, sensitive receptors and their relative exposure (considering topographic barriers and distance) were identified. Noise levels of specific construction equipment were determined and resultant noise levels at those receptors were calculated.

Potential long-term (operational) traffic, area-source, and stationary-source noise impacts were qualitatively assessed based on the number of vehicle trips and other potential operational noise sources introduced to the project area.

Groundborne vibration impacts were qualitatively assessed based on existing documentation (e.g., vibration levels produced by specific construction equipment) and the distance of sensitive receptors from the given source.

Predicted noise levels were compared with applicable standards for determination of significance. Mitigation measures were developed for significant and potentially significant noise impacts.

8.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, other Federal, State, and local guidance, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on noise would be significant if project implementation would do any of the following:

- Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

- Expose persons to or generate excessive groundborne vibration or groundborne noise levels.

- Permanently increase ambient noise levels in the project vicinity substantially above levels existing without the project.

- Temporarily or periodically increase ambient noise levels in the project vicinity substantially above levels existing without the project.

- Expose people residing or working in the project area to excessive aircraft-generated noise levels.

8.3.3 Topics Eliminated from Further Consideration

None of the project alternatives would expose people residing or working in the project area to excessive aircraft-generated noise levels because of the distance of existing airports to the project area. In addition, none of the alternatives would place new sensitive receptors near any aircraft-related facilities. There would also be no change in railway traffic as a result of any of the alternatives. Therefore, potential effects on the primary and extended study areas related to these issues are not discussed further in this DEIS.

This analysis assumes that the operation of any of the project alternatives would not generate any new significant long-term noise sources because operation and maintenance of Shasta Dam and current or relocated recreational facilities would be relatively unchanged compared to existing conditions. Relocated recreational facilities would presumably generate the same levels and types of noise, but in a slightly different location than currently exists. After completion of the dam raise, bridge and levee construction, and relocation of recreational facilities, the number of personnel serving at all sites during construction would be reduced to approximately the number currently serving to operate and maintain the facilities. Therefore, no further analysis is needed and these issues are not discussed further in this DEIS.

No effects on the current ambient noise environment would occur in the lower Sacramento River and Delta and the CVP and SWP service areas; no construction activities would occur in these geographic regions, and there would be no long-term noise sources from dam operation, modified flows in the Sacramento River and other tributaries, or water storage and conveyance throughout the CVP and SWP service areas. Therefore, potential effects related to project noise in those geographic regions are not discussed further in this DEIS.

8.3.4 Direct and Indirect Effects

No-Action Alternative

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (No-Action): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise No construction activities would occur and current operations would continue. Recreational use, population, and traffic would all increase but these increases and the effect on the noise environment would not be substantial. This impact would be less than significant.

No construction activities would occur and the dam would continue to function as it currently functions. Because no construction activities would occur under this alternative, implementation of the No-Action Alternative would not contribute toward a temporary change in the ambient noise environment. Generally, ambient noise levels could likely increase under the No-Action Alternative because greater recreational use, population growth, and traffic would occur; however, these increases would not be substantial. As a result, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Noise-2 (No-Action): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction No construction activities would occur and current operations would continue. Recreational use, population, and traffic could increase, but such source types are not considered to be major vibration sources. This impact would be less than significant.

This impact is similar to Impact Noise-1 (No-Action) for the primary study area. For the same reasons as described under Impact Noise-1 (No-Action), this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Noise-3 (No-Action): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations No construction activities would occur and current operations would continue. Recreational use, population, and traffic would all increase, but these increases and the effect on the noise environment would not be substantial. This impact would be less than significant.

This impact is similar to Impact Noise-1 (No-Action) for the primary study area. For the same reasons as described under Impact Noise-1 (No-Action), this impact would be less than significant.

Lower Sacramento River and Delta and CVP/SWP Service Areas No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects in those geographic regions are not discussed further in this DEIS.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise from activities at Shasta Dam including site preparation (e.g., excavation, grading, and clearing), raising, tree removal, material handling, blasting, demolition, site restoration and cleanup would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Increases in truck traffic from construction would also not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors. This temporary impact would be significant.

Construction activities at the Shasta Dam site under CP1 would include site preparation (e.g., excavation, grading, and clearing), the proposed dam raise, blasting, tree removal, material handling, site restoration and clean-up, and other miscellaneous activities. Temporary noise effects of the operation of heavy-duty construction equipment at the dam, blasting activities, operation of heavy-duty construction equipment at other project sites, and off-site construction traffic are addressed separately below.

Operation of Heavy-Duty Construction Equipment at the Dam The construction activities mentioned above would require the use of scrapers, excavators, bulldozers, compactors, loaders, trucks, crushers, pumps, pavers, concrete mixers, cranes, generators, and other miscellaneous pieces of equipment based on similar projects. According to the U.S. Environmental Protection Agency, noise levels generated by individual pieces of these types of equipment can range from 76 to 94 dBA at 50 feet without feasible noise control (Table 8-11). Simultaneous operation of the heavy-duty construction equipment could result in combined intermittent noise levels of approximately 94 dBA at 50 feet from the project site. Based on these noise levels and a typical noise-attenuation rate of 6.0 dBA/DD, exterior noise levels at noise-sensitive receptors located within 4,000 feet of construction activity could exceed 55 dBA Leq (the Shasta County standard for daytime hours) without noise control. However, there is a 450-foot elevation increase spanning 4,500 feet of intervening topography between the nearest receptors (residences on Lake Boulevard) and Shasta Dam. Accounting for the intervening topography attenuation, the vegetation, and the distance between the dam and receptors, an attenuation rate of approximately -100 dBA can be applied (-40 dBA for distance, -10 dBA for trees and vegetation, and -50 dBA for topographic elevation change). Thus, noise levels at the nearest sensitive receptor would be less than 50 dBA L_{dn}.

Table 8-11. Typical Construction Equipment Noise Levels

Type of Equipment	Noise Level at 50 feet (dBA)
Scraper	89
Excavator	89
Bulldozer	85
Compactor	82
Loader	85
Truck	88
Crusher	94
Pump	76
Paver	89
Concrete Pump	82
Concrete Mixer	85
Derrick Crane	88
Pile Driving (sonic)	96
Generator	81

Source: FTA 2006

Key:
dBA = A-weighted decibels

Additional residential receptors are approximately 7,000 feet down the Sacramento River from Shasta Dam. The construction-related noise level at this location would be approximately 45 dBA (95 dBA at 50 feet from construction site minus 45 dBA attenuation for distance, and minus 5 dBA attenuation from vegetation and topography). Thus, project construction noise generated by on-site construction equipment at Shasta Dam under CP1 would not expose sensitive receptors to or generate noise levels in excess of applicable standards (55 dBA daytime, 50 dBA nighttime), or to a substantial temporary increase in noise levels above existing conditions.

Blasting Activities at the Dam Construction of the Shasta Dam crest raise increase would require blasting during excavation of rock for the concrete tie-in to adjacent rock. Specific blast design parameters such as explosive type and amount (charge weight), drill pattern, and time scheme are not known at this time. However, it is anticipated that few blasts would occur each day. Blasting operations would result in airborne noise caused by the energy released in the explosion, which creates an air overpressure (airblast) in the form of a propagating wave. Still, as currently planned, single-event noise levels could exceed 110 dBA (FTA 2006). However, based on the above attenuation rates (i.e., distance between source and receptors, intervening topography and vegetation) coupled with the intermittent nature of blasting, such activities would not be anticipated to exceed applicable hourly standards.

Operation of Heavy-Duty Construction Equipment at Other Project Sites Multiple construction activities would occur at the other project-related sites (Pit River Bridge, the lakeshore area, and other areas where bridges and roads would require relocation; recreation facilities that would require removal and reconstruction; and inundation areas that would require clearing). Among the anticipated construction activities are site preparation (e.g., excavation, grading, demolition, and clearing), paving, pile driving, laying of railroad tracks, bridge relocation, removal of trees and vegetation, material handling, and site restoration and cleanup.

Based on similar projects, the on-site construction equipment required for the activities would likely include but not be limited to an excavator, bulldozer, front-end loader, grader, compactor, cranes, pile drivers, trucks, and other large pieces of equipment as necessary. According to the U.S. Environmental Protection Agency, noise levels from individual pieces of these types of equipment, when operated without feasible noise control, can range from 79 to 96 dBA at 50 feet (Table 8-11). Simultaneous operation of the three noisiest pieces of heavy-duty construction equipment, including pile driving, could result in combined intermittent noise levels of approximately 97 dBA at 50 feet from the project site. Based on these noise levels and a typical noise-attenuation rate of 6.0 dBA/DD, exterior noise levels at noise-sensitive receptors located within 75 feet of construction activity (i.e., sensitive receptors along Lakeshore Drive) could exceed 94 dBA L_{eq} without noise control. Such noise levels could exceed Shasta County standards (55 dBA daytime, 50 dBA nighttime).

Helicopters would be also used for vegetation removal during the spring and fall, when helicopters are not in use for firefighting. Helicopter noise levels range from 80 to 90 dBA at 250 feet (Caltrans 2002b). Noise levels from helicopters would be similar to those of other construction equipment described above.

Construction in areas away from the dam site would occur primarily during the daytime; however, the exact hours of construction are not specified at this time, nor has Shasta County adopted a noise ordinance that exempts construction noise from the provisions of the standard. If construction activities were to occur during the more noise-sensitive hours (evening, nighttime, and early morning), or if equipment were not properly equipped with noise-control devices, construction noise could exceed applicable noise-level standards (i.e., Shasta County's nighttime standard of 50 dBA L_{eq}) at existing noise-sensitive receptors located within 7,000 feet. In addition, any project-related construction noise generated during these more noise-sensitive hours may annoy and/or disrupt the sleep of occupants of the nearby existing noise-sensitive land uses, and temporarily but substantially increase ambient noise levels in the project vicinity. As a result, this impact would be significant.

Off-Site Construction Traffic Project construction would require approximately 350 on-site employees at any given time. Assuming two total trips per day per employee and 81 round trips per day for the transport of equipment and materials, project construction would result in a maximum of approximately 862 one-way daily trips at the dam site. Typically, traffic volumes must double before the associated increase in noise levels is noticeable (3 dBA CNEL/L_{dn}) along roadways. Given that the average daily traffic volumes are 5,500 for State Route 151, 37,000 for I-5, and 2,000 for the Lakeshore Community, traffic would not double. Therefore, adding these daily trips on the local roadway system to existing volumes would be a minor change. Consequently, project construction under CP1 would not noticeably change the traffic-noise contours of area roadways.

Summary Implementing CP1 would not result in noise levels that exceed applicable standards related to operation of heavy-duty construction equipment and blasting at Shasta Dam and off-site construction traffic. However, the impact of this alternative related to the operation of heavy-duty construction equipment at other project sites would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this temporary impact would be less than significant.

According to FTA, vibration levels associated with the use of trucks, dozers, and other heavy-duty construction equipment such as the equipment types used at project construction sites are 0.076 to 0.089 in/sec PPV and 86–87 VdB at 25 feet, and vibration levels from pile driving can reach 0.73 in/sec PPV (Table 8-10). Vibration levels generated during project construction under CP1 could exceed Caltrans's recommended standard with respect to the prevention of structural damage (0.2 in/sec PPV for buildings) and FTA's maximum-acceptable constant vibration standard of 80 VdB with respect to human annoyance for residential uses within 65 feet of the impact zone. Because there are no sensitive receptors within these distances from any of the construction sites (the nearest residences would be along Lakeshore Drive and approximately 75 feet from road and bridge construction activities taking place in the area), implementing CP1 would not generate excessive groundborne vibration or groundborne noise levels, nor would it expose persons or buildings to such groundborne vibration or noise. As a result, this temporary impact would be less than significant.

Blasting at the Shasta Dam site would result in ground vibration from the creation of seismic waves that radiate along the earth's surface. As discussed previously, no noise-sensitive receptors are located near the dam site. Receptors would need to be within 250 feet of the blasts to be affected (greater than 80 VdB) by groundborne vibration. No sensitive receptors are within this range of the dam. Therefore, this temporary impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP1): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic noise create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

Relocating Lakeshore Drive would move traffic noise closer to sensitive receptors in the Lakeshore Community. Based on roads of this size and service, it is estimated that the maximum average daily traffic in this area would be approximately 2,000 vehicles per day. Modeling by the Federal Highway Administration for a 2,000-average daily traffic two-lane roadway places the 60-dBA L_{dn} contour (Shasta County's transportation standard) at 70 feet from the roadway centerline. With the additional noise emanating from the adjacent railroad line (Shasta County 2004) and the nearest receptors farther than 75 feet from the new roadway centerline, the ambient noise level would not increase by more than 3 dBA or exceed 60 dBA (Shasta County 2004). Thus, project-generated long-term traffic noise would not result in an exceedence of the Shasta County standards. This impact would be less than significant. . Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas
Implementing CP1 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP1 in those geographic regions are not discussed further in this DEIS.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

The direct and indirect impacts of CP2 related to noise and vibration would be essentially the same as those described for CP1 because construction activities, and equipment and workforce needs, would be similar under both alternatives. Also, the long-term impact of CP2 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1. Thus, as described below, the impacts described for CP1 would generally also apply to CP2.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)
Impact Noise-1 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise

from activities at Shasta Dam including site preparation (e.g., excavation, grading, and clearing), raising, tree removal, material handling, blasting, demolition, site restoration and cleanup would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would also not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors. This impact would be the same as Impact Noise-1 (CP1) and would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) where no sensitive receptors are within this range of the dam. Therefore, this temporary impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP2): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) where the ambient noise level would not increase by more than 3 dBA or exceed 60 dBA (Shasta County 2004). Thus, project-generated long-term traffic noise would not result in an exceedence of the Shasta County standards. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1, implementing CP2 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP2 in those geographic regions are not discussed further in this DEIS.

CP3 –18.5-Foot Dam Raise, Agricultural Water Supply Reliability with Anadromous Fish Survival

The direct and indirect impacts of CP3 related to noise and vibration would be essentially the same as those described for CP1 and CP2 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP3 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP3.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise from activities at Shasta Dam including site preparation (e.g., excavation, grading, and clearing), raising, tree removal, material handling, blasting, demolition, site restoration and cleanup would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Increases in truck traffic from construction would also not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors.

This impact would be the same as Impact Noise-1 (CP1) where implementing CP3 would not result in noise levels that exceed applicable standards related to operation of heavy-duty construction equipment and blasting at Shasta Dam and off-site construction traffic. However, the impact of this alternative related to the operation of heavy-duty construction equipment at other project sites would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) where no sensitive receptors are within this range of the dam. Therefore, this temporary impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP3): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) where the ambient noise level would not increase by more than 3 dBA or exceed 60 dBA (Shasta County 2004). Thus, project-generated long-term traffic noise would not result in an exceedence of the Shasta County standards. This impact would be less than significant. . Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1 and CP2, implementing CP3 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP3 in those geographic regions are not discussed further in this DEIS.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

The direct and indirect impacts of CP4 related to noise and vibration would be essentially the same as those described for CP1 through CP3 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP4 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact of CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP4.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise from activities at Shasta Dam including site preparation (e.g., excavation, grading, and clearing), raising, tree removal, material handling, blasting, demolition, site restoration and cleanup would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Gravel augmentation under CP4 would increase the total number of construction-related truck trips, but not enough to result in a violation of traffic noise standards or a substantial increase in traffic noise. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors. This temporary impact would be significant. This temporary impact would be significant.

This impact would be similar to Impact Noise-1 (CP1), but slightly greater because of the addition of gravel augmentation along the upper Sacramento River that is proposed under CP4. The proposed gravel augmentation would result in approximately 800 truck trips per year. Assuming 44 work days, approximately 18 truck trips per day would be added to the local roadway network. In addition, the upper Sacramento River restoration sites would also be included under CP4. Upper Sacramento River restoration site construction would include an excavator, loader, and compaction equipment. Noise levels would be similar to those described under CP1 and CP2 (see Table 8-11). Approximately 350 haul trips would be needed to remove material from the site, resulting in approximately eight trips per day over a 2-month period. As discussed above under Impact Noise-1 (CP1), to generate a substantial increase in traffic noise, the traffic volume must double. Because adding 26 truck trips would not double roadway traffic volumes, no violation of traffic noise standards or substantial increase in traffic noise would occur. For the same reasons as described for Impact Noise-1 (CP1), this impact would be significant. Mitigation for this impact is proposed in Section 8.3.5.

Impact Noise-2 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1) where blasting at the Shasta Dam site would result in ground vibration from the creation of seismic waves that radiate along the earth's surface. As discussed previously, no noise-sensitive receptors are located near the dam site. Receptors would need to be within 250 feet of the blasts to be affected (greater than 80 VdB) by groundborne vibration. No sensitive receptors are within this range of the dam. Therefore, this temporary impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP4): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1) where the ambient noise level would not increase by more than 3 dBA or exceed 60 dBA (Shasta County 2004). Thus, project-generated long-term traffic noise would not result in an exceedence of the Shasta County standards. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1, implementing CP4 would not generate any new long-term noise sources outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP4 in those geographic regions are not discussed further in this DEIS.

CP5 – 18.5-Foot Dam Raise, Combination Plan

The direct and indirect impacts of CP5 related to noise and vibration would be essentially the same as those described for CP1 through CP4 because construction activities, and equipment and workforce needs, would be similar under these alternatives. Also, the long-term impact of CP5 on traffic levels associated with relocating Lakeshore Drive would be expected to be similar to the corresponding impact under CP1 and CP2. Thus, as described below, the impacts described for CP1 and CP2 would generally also apply to CP5.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Noise-1 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise Temporary construction noise from activities at Shasta Dam including site preparation (e.g., excavation, grading, and clearing), raising, tree removal, material handling, blasting, demolition, site restoration and cleanup would not exceed applicable noise-level standards at nearby noise-sensitive receptors. Construction activities at Shasta Dam would consist of site preparation (e.g., excavation, grading, and clearing), the dam raise, blasting, tree removal, material handling, demolition, and site restoration and cleanup. Gravel augmentation under CP5 would increase the total number of construction-related truck trips, but not enough to result in a violation of traffic noise standards or a substantial increase in traffic noise. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors. This temporary impact would be significant.

Like CP4, CP5 would involve gravel augmentation and restoration at sites along the upper Sacramento River, neither of which would occur under CP1, CP2, or CP3. Upper Sacramento River restoration site construction would include an excavator, loader, and compaction equipment. Noise levels would be similar to those described under CP1 and CP2 (see Table 8-11). Approximately 350 haul trips would be needed to remove material from the site, resulting in approximately eight trips per day over a 2-month period. As discussed above under Impact Noise-1(CP1), to generate a substantial increase in traffic noise, a doubling of traffic volume would be required. Because adding 26 truck trips would not double roadway traffic volumes, no violation of traffic noise standards or substantial increase in traffic noise would occur. Noise levels from construction equipment, however, would still likely exceed noise standards. Therefore, temporary, construction-related impacts would be significant.

Thus, this impact would be the same as Impact Noise-1 (CP4) and would be significant. Mitigation for this impact is proposed in Section 8.3.5. Increases in truck traffic from construction would also not cause a perceptible increase in current traffic noise levels or a noticeable difference in ambient noise levels. However, related activities at other construction sites (e.g., bridges, roads, recreation facilities) could result in noise levels that exceed applicable standards resulting in substantial increases at nearby sensitive receptors. This temporary impact would be significant.

Impact Noise-2 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction Temporary construction-related activities would not expose persons to or generate excessive groundborne vibration or groundborne noise. The additional habitat development included in CP5 would occur in uninhabited areas of Shasta-Trinity National Forest, would not affect sensitive receptors, and would be temporary. As a result, this impact would be less than significant.

This impact would be the same as Impact Noise-2 (CP1). CP5 would also involve development of additional habitat; however, habitat development would occur in an uninhabited area managed by the U.S. Bureau of Land Management, would not be expected to affect any sensitive receptors, and would be temporary. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Noise-3 (CP5): Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations Traffic associated with project operations would not expose persons to or generate noise in excess of applicable mobile-source noise standards, nor would such traffic create a substantial increase in ambient noise levels in the project vicinity. The additional habitat development included in CP5 would occur in uninhabited areas of Shasta-Trinity National Forest, would not create new operational traffic, and would not affect sensitive receptors. This impact would be less than significant.

This impact would be the same as Impact Noise-3 (CP1). CP5 would also involve development of additional habitat; however, habitat development would occur in an uninhabited area managed by the U.S. Bureau of Land Management, would not create any new operational traffic, and is not expected to affect any sensitive receptors. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas Similar to CP1 and CP2, implementing CP5 would not generate any new long-term noise outside of the primary study area. Furthermore, no construction work would occur in the extended study area; as a result, no project noise would be temporarily added to the current noise environment. No effects related to noise and vibration are expected to occur in the lower Sacramento River and Delta and the CVP/SWP service areas; therefore, potential effects of CP5 in those geographic regions are not discussed further in this DEIS.

8.3.5 Mitigation Measures

Table 8-12 presents a summary of mitigation measures for noise and vibration.

Table 8-12. Summary of Mitigation Measures for Noise and Vibration

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact Noise-1: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Construction Noise	LOS before Mitigation	LTS	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Noise-1: Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Noise-2: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Vibration During Construction	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Noise-3: Exposure of Sensitive Receptors in the Primary Study Area to Project-Generated Mobile-Source Noise During Operations	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Key:
LOS = level of significance
LTS = less than significant
S = significant

No-Action Alternative

No mitigation measures are needed for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP1) and Noise-3 (CP1). Mitigation is provided below for the remaining noise impact of CP1.

Mitigation Measure Noise-1 (CP1): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites Reclamation and its primary construction contractors will implement the measures listed below during construction:

- Construction activities at non-dam sites will be limited to the less noise-sensitive daytime hours (7 a.m. to 10 p.m., Monday through Friday).
- All construction equipment and staging areas will be located at the farthest distance possible from nearby noise-sensitive land uses.
- All construction equipment will be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds will be closed during equipment operation.
- All motorized construction equipment will be shut down when not in use to prevent idling.
- A temporary barrier will be placed as close to the noise source or receptor as possible and will break the line of sight between the source and receptor.
- A disturbance coordinator will be designated and the person's telephone number conspicuously posted around the project sites and supplied to nearby residences. The disturbance coordinator will receive all public complaints and be responsible for determining the cause of the complaint and implementing any feasible measures to alleviate the problem.

Implementation of this mitigation measure would reduce temporary project-generated construction source noise levels and limit them to the less sensitive daytime hours, thus preventing exposure of sensitive receptors to temporary construction noise at dam and non-dam sites. As a result, Impact Noise-1 (CP1) would be reduced to a less-than-significant level.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP2) and Noise-3 (CP2). Mitigation is provided below for the remaining noise impact of CP2.

Mitigation Measure Noise-1 (CP2): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP2) to a less-than-significant level.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability with Anadromous Fish Survival

No mitigation is needed for Impacts Noise-2 (CP3) and Noise-3 (CP3). Mitigation is provided below for the remaining noise impact of CP3.

Mitigation Measure Noise-1 (CP3): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP3) to a less-than-significant level.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus With Water Supply Reliability

No mitigation is needed for Impacts Noise-2 (CP4) and Noise-3 (CP4). Mitigation is provided below for the remaining noise impact of CP4.

Mitigation Measure Noise-1 (CP4): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP4) to a less-than-significant level.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is needed for Impacts Noise-2 (CP5) and Noise-3 (CP5). Mitigation is provided below for the remaining noise impact of CP5.

Mitigation Measure Noise-1 (CP5): Implement Measures to Prevent Exposure of Sensitive Receptors to Temporary Construction Noise at Project Construction Sites This mitigation measure is identical to Mitigation Measure Noise-1 (CP1). Implementation of this mitigation measure would reduce Impact Noise-1 (CP5) to a less-than-significant level.

8.3.6 Cumulative Effects

Past and present projects from areas within Shasta and Tehama counties affect noise conditions in the primary study area through the use of heavy construction equipment and the increase in traffic resulting from construction activities. Other stationary sources (e.g., railroads, traffic on existing highways) also contribute to ambient noise in the primary study area. In many cases, other related projects could create substantially more noise than the project, and would result in a cumulatively significant noise impact.

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Projects that could influence ambient noise levels in areas where the SLWRI could contribute noise include the *Shasta-Trinity National Forest Land and Resource Management Plan, Iron Mountain Mine Restoration Plan, and Mendocino National Forest Land and Resource Management Plan;* and construction of the Antlers Bridge replacement. If the listed projects were to occur concurrently with any of the project alternatives under the SLWRI (CP1–CP5), combined noise generation during construction would be unlikely to be substantial because noise is generally a local phenomenon and is minimal beyond 0.5 mile. Noise from the SLWRI would not combine with other noise sources, such as construction from the projects listed above. After project construction is completed, the ambient noise environment relative to Shasta Dam would return to existing conditions. Therefore, none of the project alternatives would make a cumulatively considerable incremental contribution to cumulative noise effects.

Lower Sacramento and Delta and CVP/SWP Service Areas

Raising Shasta Dam would not result in any short-term or long-term effects on the ambient noise environment in the extended study area under any of the project alternatives. Therefore, there would be no cumulatively considerable incremental contribution to cumulative noise effects under any of the project alternatives.

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Chapter 9
Hazards and Hazardous Materials and Waste

9.1 Affected Environment

This chapter describes the affected environment related to hazards and hazardous materials for the dam and reservoir modifications proposed under SLWRI action alternatives. Because of the potential influence of the proposed modification of Shasta Dam and water deliveries over a rather large geographic area, the SLWRI includes both a primary study area and an extended study area. The primary study area has been further divided into Shasta Lake and vicinity and the upper Sacramento River (Shasta Dam to Red Bluff). The extended study area has been further divided into the lower Sacramento River and Delta and the CVP/SWP service areas.

This section describes hazards and hazardous materials, defined as hazardous waste and hazardous substances, in the primary and extended study areas. The discussion of hazards focuses primarily on wildland fire and its related effects on the human environment and natural resources, and water safety hazards, particularly those related to Shasta Lake. Other relevant hazards, such as flooding, dam failure, and issues related to hydropower generation, public services (e.g., fire protection, law enforcement, emergency services), roadways and bridges, and recreation, are addressed in separate chapters. The effects of proposed fuels treatments, such as pile burning, on air quality are addressed in Chapter 5.

The hazards and hazardous waste setting for the primary study area consists of the portion of Shasta County above Shasta Dam and the upper Sacramento River from the dam downstream to the Red Bluff Pumping Plant, including the lands within the boundary of the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area (NRA). This area encompasses parts of the Pit River, Squaw Creek, McCloud River, and Sacramento River watersheds. The hazards and hazardous waste setting for the upper Sacramento River portion of the primary study area consists of lands draining to the Sacramento River between Shasta Dam and Red Bluff.

The hazards and hazardous waste setting for the extended study area includes the Sacramento River basin downstream from the Red Bluff Pumping Plant to the Delta, the Delta itself, the San Joaquin River basin to the Delta, portions of the American River basin, and the CVP/SWP service areas.

9.1.1 Hazards

Shasta Lake and Vicinity

Water Safety Hazards The surface waters of Shasta Lake and, to a lesser extent, Keswick Reservoir and other surface waters in the vicinity pose hazards to persons engaging in boating and other water-based activities (see Chapter 18 for a detailed discussion of water safety hazards related to recreational activities). Water safety hazards are related to equipment operations, flow velocity, morphology, instream or submerged material, accessibility, and water temperature. Working in and adjacent to water bodies also poses risks to workers.

Fluctuations in the reservoir's pool level affect the pattern of submerged obstacles, which poses a risk to boaters, water skiers, operators of personal watercraft, and workers. Reservoir drawdowns can leave rocks, shoals, and islands submerged below the water surface, where watercraft or skiers can strike them. Conversely, increases in the reservoir's pool level conceal obstacles beneath the water surface that may be visible one day and submerged the next. Most of these hazards are not marked; however, the USFS public information program warns water-based recreationists via signage and various media to use caution when operating watercraft on the lake.

Although USFS manages Shasta Lake and adjacent Federal lands comprising the NRA's Shasta Unit, law enforcement and emergency services are provided through a partnership between the Shasta-Trinity National Forest (STNF) and the Shasta County Sheriff's Office (SCSO) (see Chapter 22 for a detailed discussion of fire, law enforcement, and emergency services in Shasta Lake and vicinity). SCSO provides safety patrols and emergency response on Shasta Lake and its associated recreational areas and manages a Boating Safety Unit at the Bridge Bay Resort. SCSO staff consists of 4 full-time personnel and 22 seasonal deputies. An organized citizen volunteer patrol also assists with boater safety on Shasta Lake.

Fire Hazards Wildland fires pose a hazard to rural development, infrastructure, and natural resources. Climate, topography, vegetation characteristics, and ignition sources in a given area influence the degree of fire hazard. The California Department of Forestry and Fire Protection (Cal Fire) and STNF have delineated most of the primary study area as being at very high risk for wildland fire; some areas, such as Lakehead, are at extreme risk for fire (Figure 9-1) (Cal Fire 2005, 2008; USFS 1995; WSRCD 2010).

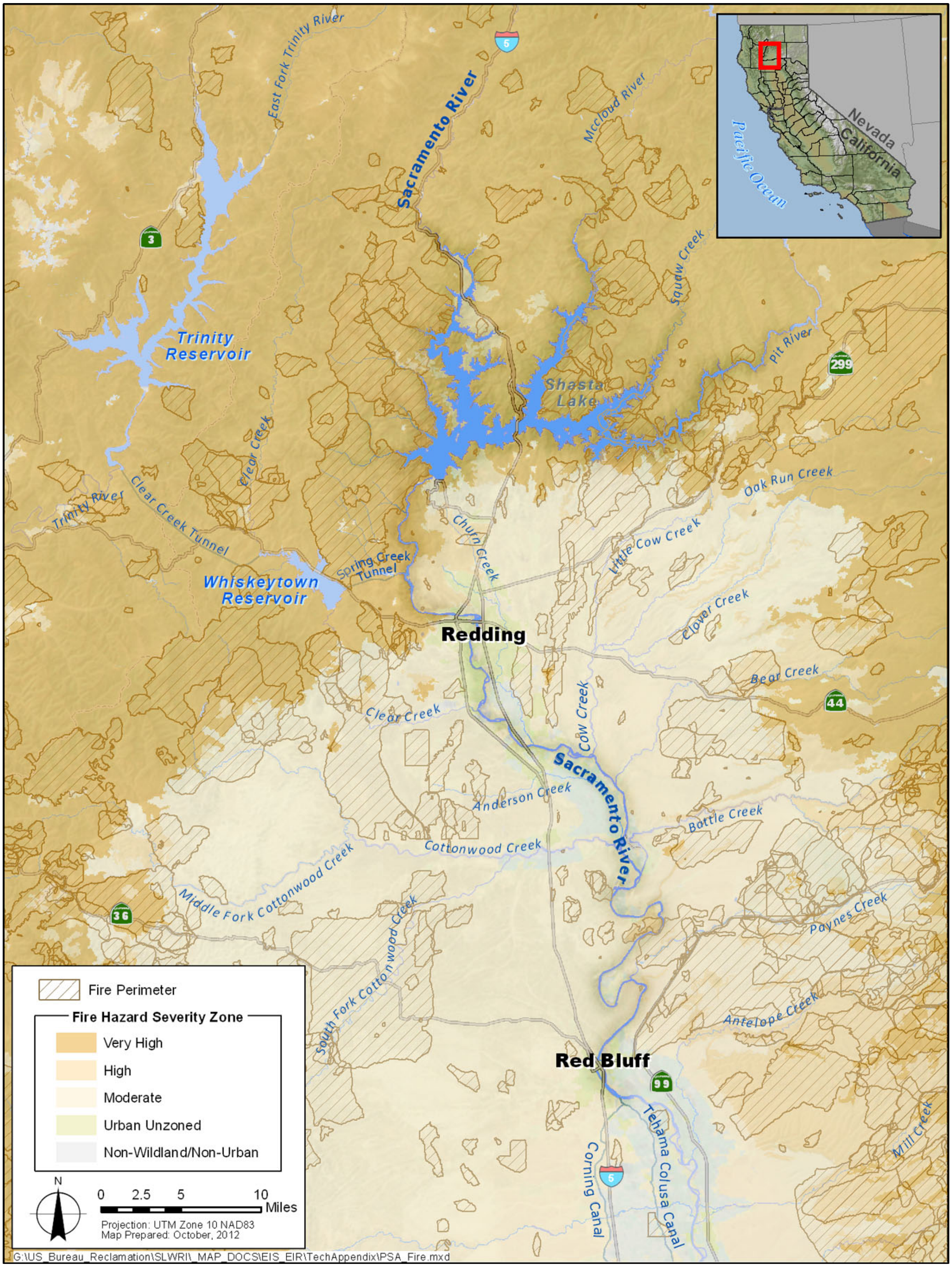

Figure 9-1. Fire Hazard Severity and Historic Fires

Historic fire data show that high-intensity, stand-replacing fires commonly occur at the lower elevations surrounding Shasta Lake. Major transportation corridors cross the NRA and the area receives high recreational use, resulting in numerous human-caused fires each year (USFS 1996). During the 5-year period from 2000 through 2004, the Shasta and Trinity units of the NRA experienced 1,545 vegetation fires affecting 40,352 acres (Cal Fire 2005). Roadside fires, abandoned campfires, and fireworks are common causes of these fires. Lightning from summer thunderstorms also causes a significant number of wildfires in and adjacent to the NRA. Large fires (more than 300 acres) that have occurred in the primary study area since 1950 are shown in Figure 9-1.

Rural and urban development has increasingly influenced the wildland fire hazard potential. Development in grasslands, oak woodlands, and forests (generally referred to as the wildland-urban interface (WUI)) and population growth have increased the risk to humans of wildland fire hazards. Cal Fire and other fire protection agencies expect this trend to continue.

Fire suppression has had a significant effect on the volume and types of fuels across the Shasta Lake region. Extreme fire weather conditions are perpetuated by high summer temperatures and dry lightning storms; particularly along the Sacramento and McCloud arms of Shasta Lake, frequent strong zonal north winds occur during the late summer and fall months. In the past 30 years, the Lakehead area, which is along the Sacramento Arm, has experienced several major fires, including the 1999 High Complex Fire, which was eventually contained at 39,000 acres, and numerous smaller fires that were suppressed in their initial stages (WSRCD 2010).

The concentration of human activity along the McCloud Arm of Shasta Lake prompted STNF to prepare a fire analysis as part of the McCloud Arm Watershed Analysis (USFS 1998). The fire analysis concludes that, at the time it was prepared (1998), more than 17,500 acres of forest surrounding the McCloud Arm was considered at high risk for a catastrophic fire. Cal Fire has designated the fire hazard severity potential in the McCloud Arm as very high (Cal Fire 2008).

The Jones Valley/Silverthorn area adjacent to the Pit Arm of Shasta Lake is another interface area with recognized fire hazards. In the last 12 years, two large fires have greatly affected residential and commercial developments in this area. In 2004, the Bear Fire burned 10,484 acres and destroyed 80 homes in the Jones Valley community, and the 1999 Jones Fire burned 26,020 acres and consumed 900 structures.

Cal Fire has devised a fire hazard severity scale that considers fuel load (vegetation is the major source of fuel), climate, and topography (fire hazards increase with slope) to evaluate the level of wildfire hazard in areas where the State is primarily responsible for fire suppression (these are known as State Responsibility Areas). Cal Fire designates three levels of fire hazard severity zones – moderate, high, and very high – to indicate the severity of fire hazard in a particular geographical area. Based on a review of Cal Fire's statewide map of fire hazard severity zones, the primary study area includes lands designated as high and very high (Figure 9-1) (Cal Fire 2007).

Fuels management actions are conducted with some frequency on Federal lands in the Shasta Lake and vicinity portion of the study area. Since 2009, USFS has completed, or is currently proposing, several fuels management projects along the various arms of Shasta Lake, including the Bear Hazardous Fuels Project (Pit Arm), the Green-Horse Habitat Restoration and Maintenance Project (between the Pit and McCloud arms), the Interstate-5 Corridor Fuels Reduction Project (upper Sacramento Arm), and the Packers Bay Invasive Plant Species Removal Project (Sacramento Arm) (USFS 2009, 2011).

Upper Sacramento River (Shasta Dam to Red Bluff)

Water Safety Hazards Water safety hazards in the upper Sacramento River are similar to those in Shasta Lake and vicinity. Surface waters (i.e., Keswick Reservoir and the Sacramento River) pose hazards to persons engaging in boating and other water-based activities on these water bodies. Water hazards are posed by equipment operations, flow velocity, morphology, instream or submerged material, accessibility, and water temperature. Working in and adjacent to water bodies also poses risks to workers.

Fire Hazards Wildland and nonwildland fires present hazard risks to rural and urban development in the upper Sacramento River area. Based on a review of Cal Fire's statewide map of fire hazard severity zones, the upper Sacramento River area includes lands designated as high and very high risk (Figure 9-1) (Cal Fire 2007).

Human activities such as smoking, debris burning, and equipment operation cause 90 percent of the wildland fires in Shasta County, and lightning causes the remaining 10 percent. Wildland fires present a major safety hazard to rural development located in forest, brush, and grass-covered areas. Between 1992 and 2003, an average of 333 wildland fires per year occurred in Shasta County; the majority of these fires were in upland areas, where fire hazards are extreme because of an abundance of highly flammable vegetation and long, dry summers (Shasta County 2004). Large fires (more than 300 acres) that have occurred in the primary study area since 1950, including the upper Sacramento River near Shasta Dam, are shown in Figure 9-1.

Much of Tehama County, outside of the valley floor, is classified as wildland and contains substantial forest fire risks and hazards (Tehama County 2009). Outside of urbanized areas, fire hazard is considered to be moderate (Cal Fire 2007). Encroachment by development into previously uninhabited areas has expanded the WUI, compounding the challenges of wildland fire management. In the portion of the project area that is in Tehama County, no large fires (greater than 300 acres) have occurred in the last 60 years (Figure 9-1) (Cal Fire

2009), because vegetation adjacent to the Sacramento River is not conducive to carrying wildland fire.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Water safety hazards are similar to those described for the primary study area. Fire hazard in the extended study area varies, with risk increasing proportionally with the degree of WUI. As noted previously, Cal Fire maintains a map-based program that identifies fire hazard severity zones throughout the state. The program differentiates between State Responsibility Areas and Local Responsibility Areas. Most of the extended study area is mapped as local (or Federal) responsibility areas with moderate or unzoned fire hazard severity classifications (Cal Fire 2008).

9.1.2 Hazardous Materials and Waste

For purposes of this section, the term “hazardous materials” refers to both hazardous substances and hazardous wastes. A hazardous material is defined in the Code of Federal Regulations (CFR) as “a substance or material that … is capable of posing an unreasonable risk to health, safety, and property when transported in commerce” (49 CFR 171.8). California Health and Safety Code Section 25501 defines a hazardous material as follows:

> *“Hazardous material” means any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. “Hazardous materials” include, but are not limited to, hazardous substances, hazardous waste, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.*

Hazardous wastes are defined in California Health and Safety Code Section 25141(b) as wastes that

> *…because of their quantity, concentration, or physical, chemical, or infectious characteristics, [may either] cause, or significantly contribute to an increase in mortality or an increase in serious illness [or] pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.*

Potential sources of hazardous materials and wastes may exist in the urbanized, rural, industrial, and agricultural portions of the study areas. Hazardous materials may be present in a variety of common contexts, including the following:

- Construction and demolition debris
- Drums
- Landfills or solid waste disposal sites
- Pits, ponds, or lagoons
- Wastewater and wastewater treatment plants
- Fill, dirt, depressions, and mounds
- Herbicides, pesticides, and fungicides
- Contaminated aggregate (mercury, dioxin)
- Explosives
- Fish hatcheries (e.g., Livingston Stone, Coleman)
- Underground and above ground storage tanks
- Stormwater runoff structures
- Transformers that may contain polychlorinated biphenyls (PCB)
- Utility poles
- Abandoned mines

Shasta Lake and Vicinity

Facilities used to store, generate, and transport hazardous materials and hazardous waste are present upstream from Shasta Dam. In addition, several inactive or abandoned mines contribute hazardous materials to Shasta Lake or its tributaries. The following discussion describes these features and facilities.

Reclamation operates the Shasta Dam facility and controls the use and movement of hazardous materials and associated hazardous waste in and out of the Shasta Dam administrative compound. Operation and maintenance of the dam and the water project facility require the use of many of the hazardous materials listed in the previous section. In addition, utility poles, transformers, and associated power transmission facilities typically contain hazardous materials.

A number of recreational facilities are located on or adjacent to Shasta Lake. These facilities include marinas, campgrounds, day use facilities, and residences for recreational use. Although several of these are privately owned, most are operated under special use permits issued by USFS. Operation and maintenance of recreational facilities involve the use of a number of substances that are considered hazardous under Federal or State statutes. The STNF administrative facility at Turntable Bay contains substances used for maintenance of the facility, STNF boats, and recreation facilities throughout the NRA. Access to these substances is controlled by STNF in accordance with Federal, State, and local requirements. Additionally, public facilities that service and/or repair watercraft (e.g., marinas) generate wastes that are considered hazardous (e.g., oil, grease, solvents).

Currently, there are three underground fuel storage tanks permitted by the State Water Resources Control Board in the primary study area, all of which are in the Shasta Lake and vicinity portion of the primary study area: Holiday Harbor, Sugarloaf Marina, and Digger Bay Marina (SWRCB 2012). Also in the Shasta Lake and vicinity portion are four underground fuel storage tanks that are no longer in use due to regulatory actions resulting from documented occurrences of fuel leaks (SWRCB 2012).

The project would include the decommissioning/abandonment and/or relocation of a number of features and facilities on or adjacent to Shasta Lake. Underground and aboveground fuel storage tanks – including tanks in use and tanks no longer used – would be permanently removed from areas that would be inundated by the project. Above- and belowground fuel pipelines within the inundation area would be relocated/removed. Relocated fuel storage tanks would be designed and constructed in accordance with Title 23 of the California Code of Regulations (Division 3, Chapter 15, Underground Tank Regulations); the Uniform Fire Code; California Air Resources Board; Shasta County Development Standards, Section 6.7; and Shasta County Environmental Health Division requirements. Additionally, the age of some buildings suggests that substances such as asbestos or lead paint may be included in demolition debris.

A records search of the Federal Superfund National Priorities List (NPL) (USEPA 2013) identified no sites in the Shasta Lake and vicinity portion of the study area. In its scoping comments, the Central Valley Regional Water Quality Control Board (CVRWQCB) identified three sites that are currently subject to some degree of remediation. These sites are associated with the Bully Hill/Rising Star Mine and the Digger Bay and Sugarloaf marinas. All three sites may be influenced by fluctuating water levels in Shasta Lake. An additional site near the Bully Hill Mine complex contains depositional features with elevated metal concentrations that are exposed to surficial and wave erosion processes. The CVRWQCB has also identified an abandoned mine complex west of Shasta Dam as a source of heavy metals and acid mine discharge that enters Shasta Lake via Dry Creek.

Interstate 5 (I-5) and Union Pacific Railroad transportation corridors are in close proximity to Shasta Lake and its tributaries. The potential exists for the accidental spill of chemicals and hazardous materials transported along these travel corridors. Transport through mountainous terrain and over water bodies, equipment failure, and improper storage and handling of hazardous materials contribute to the risk of accidental chemical spills.

The Cantara Spill is a prime example of the hazards associated with the transport of hazardous materials through the region. On July 14, 1991, a Southern Pacific train derailed upstream from Dunsmuir, sending several cars into the Sacramento River, including a tank car containing the herbicide/pesticide metam sodium (a potent chemical used principally to sterilize soil for agricultural purposes). A rupture in one of the tank cars resulted in the catastrophic spill of approximately 19,000 gallons of the soil fumigant into the river. When mixed with water, metam sodium breaks down into several highly toxic compounds. Although the toxins formed by the mixing of metam sodium with water dissipated in a matter of hours or weeks, the immediate effects of the spill were staggering. In the upper Sacramento River, every living aquatic creature downstream from the spill died over the 20-mile stretch of river between the spill and Shasta Lake (Cantara Trustee Council 2007). On July 17, 1991, the plume, estimated to have traveled at just under 1 mile per hour, entered Shasta Lake, where the chemical was reduced to undetectable levels approximately 2 weeks later. As a result of the Cantara Spill, more than $14 million in settlement funds – administered by the Cantara Trustee Council – was used for ecosystem restoration efforts throughout the primary study area.

Historic mining activities in the Shasta Lake and vicinity portion of the primary study area have left mine tailing deposits scattered throughout the uplands surrounding the lake. These deposits often contain high concentrations of various metals, including iron, copper, zinc, and mercury. The discharge of these dissolved metals into waterways can have an adverse effect on water quality, aquatic ecosystems, and human health. The historic Bully Hill Mine, located along the Squaw Arm, is the only mine site that would be inundated by the project. The effects on water quality that could result from the inundation of mine tailings are discussed in detail in Chapter 7.

Upper Sacramento River (Shasta Dam to Red Bluff)

A number of business and industrial land uses downstream from Shasta Dam use and transport hazardous materials as part of their operations. Existing land uses that may have a hazardous material component include mining operations, heavy and light industrial uses, propane/petroleum fueling and/or storage facilities, and commercial and retail operations. Businesses that require storage of hazardous materials must submit a Hazardous Material Business Plan (HMBP) to the Shasta County Environmental Health Department. I-5, Union Pacific Railroad lines, and several major surface routes are used for the transportation of hazardous materials throughout the region.

Hazardous waste sites associated with agricultural activities include storage facilities and agricultural ponds or pits contaminated with fertilizers, pesticides, herbicides, or insecticides. Petroleum products and other materials may also be present in the soil and groundwater near leaking underground tanks used to store these materials. However, there are no permitted underground fuel storage tanks – Including tanks currently in use or tanks that have been subject to regulatory actions – within the project boundaries for the upper Sacramento River portion of the primary study area (SWRCB 2012).

Metals such as cadmium, copper, mercury, and zinc are present in inactive and abandoned mines in the upper Sacramento River area. Landfills and commercial activities, such as dry cleaning, could also be sources of contamination in this region. The project would not result in the inundation of any of these potentially hazardous locations.

A records search of the U.S. Environmental Protection Agency's (EPA) NPL identified one site in the upper Sacramento River area: Iron Mountain Mine. The mine is a privately owned site southwest of Shasta Dam and 9 miles northwest of Redding. The entire mine area, which encompasses about 2,000 acres, is drained by Boulder Creek and Slickrock Creek, tributaries to Spring Creek. Spring Creek enters Keswick Reservoir several miles downstream from Shasta Dam.

From the 1860s through 1963, the 4,400-acre Iron Mountain Mine was periodically mined for iron, silver, gold, copper, zinc, and pyrite. Although mining operations were discontinued in 1963, underground mine workings, waste rock dumps, piles of mine tailings, and an open mine pit remain at the site. Historic mining activity at Iron Mountain Mine has fractured the rock units, exposing minerals to surface water, rainwater, and oxygen. Acidic mine drainage typically contains high concentrations of copper, cadmium, zinc, and other heavy metals. Much of the acidic mine drainage ultimately is channeled into Spring Creek Reservoir via adjacent creeks and constructed diversion facilities. The low pH level and the heavy metal contamination from the mine have virtually extirpated aquatic life in sections of Slickrock Creek, Boulder Creek, and Spring Creek. (Project effects on potentially contaminated historic mine waste are discussed in Chapter 7.)

Reclamation periodically releases water from Spring Creek Reservoir into Keswick Reservoir. Planned releases are timed to coincide with the presence of diluting releases of water from Shasta Dam. On occasion, uncontrolled spills and excessive waste releases have occurred when Spring Creek Reservoir reaches capacity. Without sufficient dilution, these events have resulted in the release of harmful quantities of heavy metals into the Sacramento River downstream from Keswick Dam. Acid mine drainage and associated heavy-metal contamination from the Spring Creek drainage and other abandoned mine sites are among the principal water quality issues in the upper Sacramento River portion of the primary study area (EPA 2008). In 2009, EPA began the removal of approximately 200,000 cubic yards of contaminated sediment from the Spring Creek Arm of Keswick Reservoir for disposal in an engineered disposal cell. The project was completed in 2010 and restored active storage space to Reclamation's Keswick Reservoir.

The Livingston Stone National Fish Hatchery facility, located at the foot of Shasta Dam, is used to propagate adult winter-run Chinook salmon collected from the mainstem Sacramento River. Water from Shasta Dam is used to supply the hatchery and waste is discharged to the Sacramento River downstream from the dam. The facility's discharge is regulated under CVRWQCB General Order R5-2010-0018 (National Pollutant Discharge Elimination System No. GAG135001) Waste Discharge Requirements for Cold-Water Concentrated Aquatic Animal Production Facility Discharges to Surface Waters (CVRWQCB 2010).

Lower Sacramento River and Delta and CVP/SWP Study Areas

Many of the land uses in the extended study area are similar to those in the primary study area. Thus, contamination is possible from agricultural, urban, industrial, commercial, landfill, and military land uses in the region. Because the extended study area covers many counties and regions, a records search of the NPL and the California Department of Toxic Substances Control list was not conducted. Although many sites in the extended study area undoubtedly are on these lists, it is not expected that these sites would be affected by project implementation.

Facilities created by CVP/SWP for the purposes of water conservation and management include dams, power plants, and an extensive canal system. Operation of these facilities involves the use of a variety of hazardous materials such as lubricants.

The Sacramento National Wildlife Refuge Complex consists of 5 national wildlife refuges and 3 wildlife management areas covering over 35,000 acres of wetlands and uplands, in addition to more than 30,000 acres of conservation easements. Many of the wetlands in the Sacramento Valley receive water not only from the Sacramento River, but also from agricultural runoff. Urban, industrial, agricultural, and natural sources of toxins contribute to water quality problems in the lower Sacramento River and Delta and can pose a hazard to fish and wildlife through processes such as bioaccumulation in the food chain.

A discussion of the current water quality and potential hazards to water quality associated with the project is presented in Chapter 7.

9.2 Regulatory Framework

9.2.1 Federal

Federal Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is a Federal statute designed to provide "cradle to grave" control of hazardous waste by imposing management requirements on generators and transporters of hazardous wastes, and on owners and operators of treatment, storage, and disposal facilities. The EPA is responsible for administering the RCRA.

Federal Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund Act, provides for the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites. CERCLA authorized the NPL, which identifies contaminated sites that are eligible for remedial action. The scope of CERCLA is broad; it holds current and prior owners and operators of contaminated sites responsible, and its definition of a hazardous substance incorporates definitions from the Clean Air Act, the Clean Water Act, the Toxic Substances Control Act, and the RCRA (CERCLA Section 101(14)). EPA is the agency responsible for administering CERCLA.

Occupational Safety and Health Act

The Occupational Safety and Health Act defines occupational health and safety standards with the goal of providing employees with a safe working environment. The California Occupational Safety and Health Administration (Cal/OSHA) is the agency responsible for administering this Federal act. The Occupational Safety and Health Administration (OSHA) regulations apply to the workplace and cover activities ranging from confined space entry to toxic chemical exposure. Employers are required to provide a workplace free of recognized hazards that could cause serious physical harm. OSHA regulates workplace exposure to hazardous chemicals and activities through workplace procedures and equipment requirements (29 U.S. Code 651–678).

Hazardous Materials Transportation Act

The Hazardous Materials Transportation Act regulates interstate transport of hazardous materials and wastes. This act specifies driver training requirements, load labeling procedures, and container design and safety requirements. Transporters of hazardous wastes must also meet the requirements of other statutes, such as the RCRA. The Hazardous Materials Transportation Act requires that carriers report accidental releases of hazardous materials to the U.S. Department of Transportation at soon as is practical (49 CFR Subchapter C). Incidents that must be reported include deaths, injuries requiring hospitalization, and property damage exceeding $50,000. The U.S. Department of Transportation, the Federal Highway Administration, and the Federal Railroad Administration are the agencies responsible for administering the Hazardous Materials Transportation Act.

Code of Federal Regulations, Title 36

Title 36 of the CFR governs parks, forests, and public property in the United States. Chapter 2, Section 260, pertains to prohibited activities within the boundaries of Federally owned lands and waters administered by USFS. USFS is responsible for administering the regulations described as follows.

Section 261.5 Fire (General Prohibitions) The following are prohibited:

- Carelessly or negligently throwing or placing any ignited substance or other substance that may cause a fire
- Firing any tracer bullet or incendiary ammunition
- Causing timber, trees, slash, brush, or grass to burn except as authorized by permit
- Leaving a fire without completely extinguishing it
- Allowing a fire to escape from control
- Building, attending, maintaining, or using a campfire without removing all flammable material from around the campfire adequate to prevent its escape

Section 261.52 Fire (Prohibitions in Areas Designated by Order) When provided by an order, the following are prohibited:

- Building, maintaining, attending or using a fire, campfire, or stove fire
- Using an explosive
- Smoking, except within an enclosed vehicle or building, a developed recreation site, or while stopped in an area at least 3 feet in diameter that is barren or cleared of all flammable material
- Possessing, discharging, or using any kind of firework or other pyrotechnic device

Shasta-Trinity National Forest Land and Resource Management Plan

The STNF Land and Resource Management Plan (LRMP) contains goals, standards, and guidelines designed to guide the management of STNF. The following goals, standards, and guidelines relative to hazards and/or hazardous materials issues associated with the project area were excerpted from the LRMP (USFS 1995).

Facilities Goals (LRMP, p. 4-17)

- Provide and maintain those administrative facilities that effectively and safely serve the public and USFS work force.

Facilities Standards and Guidelines (LRMP, p. 4-17)

- Upgrade the surfacing on the forest's road system as necessary to protect the road and other resource values.
- Trails will be maintained as needed for specific management objectives. Erosion control and primary access will receive priority.
- Trails and trail bridges will be located, designed, constructed, and maintained so that they are suitable for the type of travel being served.
- Consider volcanic, seismic, flood, and slope stability hazards in the location and design of administrative and recreation facilities.
- Manage, construct, and maintain buildings and administrative sites to meet applicable codes and to provide the necessary facilities to support resource management.
- Monitor potable water sources and designated swimming areas according to the Safe Drinking Water Act and other regulatory health requirements.

Management Guide for the Shasta and Trinity Units of the Whiskeytown-Shasta-Trinity National Recreation Area

The NRA Management Guide contains management strategies intended to achieve or maintain a desired condition. These strategies take into account opportunities and general management and mitigation measures to achieve specific goals. STNF is responsible for administering the following strategies related to hazards and/or hazardous materials issues associated with the project area.

Fire and Fuels (Management Guide, p. IV-1)

- Treatment of fuels created by project activities will be determined during project planning.
- Treatment of natural fuels for hazard reduction will be high priority in and around urban interface areas. Treatment of natural fuels near developed recreation sites will be a secondary priority, unless hazard and risk analysis shows a specific need.

Health and Safety (Management Guide, pp. IV-15 through IV-16)

- Resorts/marinas are responsible for inspecting their own facilities to ensure that they comply with applicable laws, ordinances, and codes and standards for health and safety and are safe for public use. Copies of all health and safety inspections must be incorporated in the operation and maintenance plan annually and be available to STNF.

- Marinas are required to anchor docks using underwater cables and anchor systems. Minor exceptions may be made, with STNF approval, in areas where low-speed boating is required, such as behind a marina in a semi-enclosed, restricted waterway. If cables and anchors are positioned in main travel-ways where they can come in contact with boats or people, the cables must be flagged and have warning lights so that they are visible day and night.

- Buoys and floats placed and maintained by marinas must meet the following criteria:

  – If the float or buoy is constructed of a material that will not damage a boat or cause personal injury on contact, the float or buoy must be of a contrasting color that can be easily seen. Examples are floats and buoys made of lightweight Styrofoam and plastic.

  – If the float or buoy is made of a material that could damage a boat or cause personal injury on contact, it must be of a contrasting color that can be easily seen, and must have a blinking yellow light visible from 360 degrees for night boating safety. Examples are floats and buoys made of steel or aluminum.

  – Log booms may be installed around marinas to suppress wave action at the docks. Log booms must not infringe on the main boating channels. Log booms must have yellow blinking lights installed every 100 feet on or immediately adjacent to the boom so that the boom's location is visible at night. Boating entrances through log booms or other breakwaters will display red and green navigation lights on either side of the log boom or breakwater for nighttime navigation.

  – All docks that are approved to extend out into a main boating travel-way, and are not protected by a lighted breakwater or other lighting system, must have at least 1 blinking yellow light for nighttime boating safety every 100 feet.

- No work that would leave pollutants in the lake when the area is inundated is permitted below the lake high-water line. Examples of this are water blasting and sand blasting pontoons and mechanical repairs that would allow oil and grease to drain on the ground.

- Resorts/marinas may restrict vehicle nighttime land access to their facilities if they can display to STNF that such action is needed to protect people and property.

Vegetation (Management Guide, p. IV-18)

- Prescribed burning, fuel break construction, and other forms of vegetation manipulation will be used to reduce fire hazards and improve forest health.

- Hazard trees in traditionally high-use recreation areas that pose safety hazards to people or property will be identified and removed.

U.S. Bureau of Land Management Resource Management Plan

The U.S. Department of the Interior, Bureau of Land Management (BLM) manages a number of public lands adjacent to the Sacramento River corridor downstream from Shasta Dam. The study area falls under two BLM districts (Northern California and Central California) and the resource management plans of three BLM field offices: Redding, Ukiah, and Mother Lode (BLM 2006a). The purpose of BLM's resource management plans is to provide an overall direction for managing and allocating public resources in each planning area. BLM is responsible for administering the following strategies related to hazards and/or hazardous materials issues common to the districts in the study area (BLM 1992, 2006b, 2008).

Wildfire Suppression Goal

- Provide an appropriate management response for all wildland fires, emphasizing firefighter and public safety.

Fuels Management Goals

- Reduce fire risk to the wildland-urban interface communities.

- Protect riparian and wetland areas.

- Improve ecological conditions and reduce the risk of catastrophic wildfire through the use of prescribed burning.

- Improve ecological conditions and reduce the risk of catastrophic wildfire through mechanical treatments.

- Increase the public's knowledge of the natural role of fire in the ecosystem, and hazards and risks associated with living in the wildland-urban interface.

Hazardous Materials

- Land use authorizations will not be issued for uses that would involve the disposal or storage of materials that could contaminate the land (e.g., hazardous waste disposal sites, landfills, rifle ranges).

- Minimize hazardous conditions on BLM lands to reduce risks to the public and ensure environmental health and safety.

9.2.2 State

Strategic Fire Plan

The 2010 Strategic Fire Plan for California (State Board of Forestry and Fire Protection and Cal Fire 2010) is a broad strategic document that guides fire policy for much of California. It was authorized under California Public Resources Code Section 4114 and Section 4130 to establish, among other things, the levels of statewide fire protection services for State Responsibility Area lands. The plan is a cooperative effort between the State Board of Forestry and Fire Protection and Cal Fire. It emphasizes what needs to be done long before a fire starts, and looks at ways to reduce firefighting costs and property losses, increase firefighter safety, and contribute to ecosystem health. The plan serves as the basis for assessing California's complex and dynamic natural and human-made environment, and identifies a variety of actions to minimize the negative effects of wildland fire.

The mission of the State Board of Forestry and Fire Protection is to lead California in developing policies and programs that serve the public interest in environmentally, economically, socially sustainable forest and rangeland management, and a fire protection system that protects and serves the people of the state. Its statutory responsibilities are to:

- Establish and administer forest and rangeland policy for the State of California
- Protect and represent the State's interest in all forestry and rangeland matters
- Provide direction and guidance to Cal Fire on fire protection and resource management
- Accomplish a comprehensive regulatory program for forestry and fire protection
- Conduct its duties to inform and respond to the people of the State of California

Hazardous Waste Control Act

The California Hazardous Waste Control Act governs hazardous waste management and cleanup in the State (Health and Safety Code, Chapters 6.5–6.98). The act mirrors the RCRA and imposes a "cradle to grave" regulatory system for handling hazardous waste in a manner that protects human health and the environment. It requires all businesses to report the quantity and locations of hazardous materials on an annual basis if the business stores (a) more than 55 gallons of a liquid or 500 pounds of a solid hazardous material, (b) more than 200 cubic feet of a compressed gas, or (c) a radioactive material that is handled in quantities for which an emergency plan is required. Businesses falling within these limits must prepare an HMBP, which includes spill prevention, containment and emergency response measures and a contingency plan.

County Environmental Health Departments and the California Environmental Protection Agency's (Cal/EPA) Certified Unified Program Agencies assume responsibility for enforcing local hazardous waste reporting requirements. Sites that store, handle, or transport specified quantities of hazardous materials are inspected annually. The California Department of Toxic Substances Control, part of Cal/EPA, regulates the generation, transportation, treatment, storage, and disposal of hazardous waste under the RCRA and the State Hazardous Waste Control Act.

Hazardous Substances Account Act

California enacted the Hazardous Substances Account Act (1981) to establish State authority to clean up hazardous substances releases, compensate persons injured from exposure to hazardous substances, and provide funds for payment of the State's mandatory 10 percent share of cleanup costs under the Federal Superfund law. Cal/EPA administers the State Superfund program and receives assistance from the California Department of Public Health.

Emergency Response Plan

California developed an Emergency Response Plan to facilitate and coordinate responses to emergencies. Emergency prevention and response to hazardous materials incidents are part of the State plan that is administered by the California Emergency Management Agency (formerly Governor's Office of Emergency Services). Coordinating agencies include Cal/EPA, the California Highway Patrol (CHP), Cal Fire, local fire departments, the California National Guard, the California Department of Transportation (Caltrans), California Department of Fish and Wildlife, regional water quality control boards, and other emergency service providers.

California Code of Regulations, Title 13, Vehicle Code

In addition to the RCRA hazardous waste transportation standards, California regulates the transportation of hazardous waste originating or passing through the state. State regulations are contained in the California Code of Regulations (CCR), Title 13, Vehicle Code. Hazardous waste must be regularly removed from generating sites by licensed hazardous waste transporters. Transported materials must be accompanied by hazardous waste manifests.

CHP and Caltrans are responsible for enforcing Federal and State regulations pertaining to the transport of hazardous materials through California. CHP enforces materials and hazardous waste labeling and packaging regulations that prevent leakage and spills of material in transit and provides information to cleanup crews in the event of an incident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of CHP. CHP conducts regular inspections of licensed transporters to assure regulatory compliance. CHP and Caltrans also respond to hazardous materials transportation emergencies. Caltrans has emergency chemical spill identification teams at locations throughout the state.

Worker Safety Requirements

Regulations pertaining to the use of hazardous materials in California workplaces are provided in CCR Title 8 and include requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal/OSHA standards are more stringent than Federal OSHA regulations.

As described above, Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations in the state. Cal/OSHA enforces hazard communication program regulations that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating information related to hazardous substances and their handling, and preparing health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that material safety data sheets be available to employees and that employee information and training programs be documented.

Government Planning

California law requires that each county and city in the state adopt a general plan (Government Code Section 65300). The State-mandated general plans consist of development policies and objectives for the long-term physical development of counties and cities. Each general plan must include a safety element that addresses a variety of natural and human-caused hazards. At a minimum, the safety element must adopt policies related to fire safety, flooding, and geologic and seismic hazards (Government Code Section 65302(g)).

California Building Code

In 2007, the California Building Code was amended to include regulations pertaining to fire safety. The amendments provide safety standards for new construction located in WUI areas. The building code requires landowners to maintain an area of defensible space around structures and requires the use of fire-resistant building materials. County building inspectors, Cal Fire, and local fire agencies are responsible for enforcing the requirements (CCR Title 24, Part 2). On Federal lands, the Federal agency is responsible for ensuring that buildings and facilities meet public health and safety standards.

9.2.3 Regional and Local

County General Plans

The general plans for the counties in the primary and extended study areas contain general policies aimed at reducing the use of hazardous substances and the generation of hazardous waste and ensuring safe use and storage of hazardous materials and management of hazardous waste.

County Fire Management Plans

Fire Management Plans have been prepared for Tehama County and Shasta County (Cal Fire and Tehama Fire-Safe Council 2005; SCFD 2007; Cal Fire 2005). The plans tier from the California Fire Plan and are intended to be used for prefire planning, prioritization, and implementation. The plans outline cooperative efforts of local fire agencies, Cal Fire, and fire safe councils.

9.3 Environmental Consequences and Mitigation Measures

9.3.1 Methods and Assumptions

This analysis addresses potential impacts associated with implementation of the project with respect to hazards and hazardous materials. This analysis is based on a review of planning documents applicable to the project area, consultation with appropriate agencies, and field reconnaissance.

9.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the projects. Under NEPA, the significance of an effect is used solely to determine whether an EIS must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions in the area affected by the project (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria are based on guidance provided by CEQA Guidelines (AEP 2010) and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on hazards and hazardous materials would be significant if project implementation would do any of the following:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment

- Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan
- Expose people or structures to a significant risk of loss, injury, or death involving wildland fires

9.3.3 Topics Eliminated from Further Consideration

Water safety hazards posed by the project alternatives to water-based recreationists are assessed in Chapter 18; therefore, this topic has been eliminated from further analysis in this chapter. Similarly, the effects of hazardous materials on water quality are assessed in Chapter 7.

9.3.4 Direct and Indirect Effects

Information on fire risk and severity was obtained from USFS and Cal Fire. This information was used to identify specific types and locations of activities that could present a threat to the human environment as a result of wildland fires.

A regulatory database search was conducted for portions of the primary study area. The purpose of such a search was to identify sites that are associated with the documented use, generation, storage, or release of hazardous materials or petroleum products. The results also include regulatory lists of known or potential hazardous waste sites, landfills, hazardous waste generators, and disposal facilities, in addition to sites under investigation. Information provided in the database search was obtained from publicly available sources, including the following:

- Cortese List (DTSC 2012)
- Leaking Tanks (SWRCB 2012)
- Comprehensive Environmental Response, Compensation and Liability Information System: EPA Superfund Sites (USEPA 2013)
- Annual Work Plan (SWRCB et al. 2008)

No-Action Alternative

Shasta Lake and Vicinity, Upper Sacramento River (Shasta Dam to Red Bluff), Lower Sacramento and Delta, and CVP/SWP Service Areas

Impact Haz-1 (No-Action): Wildland Fire Risk Under the No-Action Alternative, no new facilities would be constructed in the primary or extended study areas and no changes in Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increase in the risk of wildland fire in the project area. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Haz-2 (No-Action): Release of Potentially Hazardous Materials or Hazardous Waste Under the No-Action Alternative, no new facilities would be constructed in the primary or extended study areas and no changes in Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increase in hazards, hazardous materials, or hazardous waste in the project area. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Haz-3 (No-Action): Exposure of Workers to Hazardous Materials Under the No-Action Alternative, no new facilities would be constructed in the primary or extended study areas and no changes in Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increase in exposure of workers to hazards, hazardous materials, or hazardous waste in the project area. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Haz-4 (No-Action): Exposure of Sensitive Receptors to Hazardous Materials Under the No-Action Alternative, no new facilities would be constructed in the primary or extended study areas and no changes in Reclamation's existing facilities or operations would occur that would directly or indirectly result in any increase in hazards, hazardous materials, or hazardous waste in the project area. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Haz-1 (CP1): Wildland Fire Risk Project implementation could contribute to wildland fire risk. Project construction and operation, and the anticipated postconstruction human activity in the primary study area would increase the potential for fire ignition. Therefore, this impact would be potentially significant.

Wildland fire in the primary study area would expose people, structures, infrastructure, and other resources to a significant risk of loss, injury, or death. Project design, implementation, and operation incorporate safety measures that prevent fire hazards. Although the construction details have not been finalized, this conclusion is based on the scope of activities involved and the fire hazard ratings (i.e., very high risk and extreme risk) in the primary study area and the relocation sites where project construction activities would occur. Construction activities would likely occur during the summer and fall months, which are generally considered a time of high fire hazard in Northern California. Reclamation and its contractors would follow fire safety regulations and procedures to prevent accidental fires.

Project activities associated with the removal and relocation of utilities could pose a wildland fire hazard in the primary study area, although it is anticipated that 100 percent vegetation clearance beneath high-voltage power transmission lines (typically 60-230 kilovolts) would be maintained. Under CP1, approximately 30,300 feet (5.7 miles) of power transmission lines and 59,400 feet (11.3 miles) of telecommunications lines would require demolition and relocation to prevent inundation by the new reservoir elevation resulting from project implementation. In addition, six power towers would be demolished, and six new towers would be constructed in new locations. CP1 also involves several miles of road construction and demolition of several vehicle and railroad bridges.

Other utility relocations and/or construction proposed under CP1 include potable water facilities, gas/petroleum facilities, and wastewater facilities. Vegetation clearing would be required to varying degrees for most utility relocation/construction, some of which would be located in densely vegetated areas. During construction/relocation, the potential would exist for the ignition of fire by construction equipment operating in the area. Although the increased risk of ignition would be short term (i.e., during implementation), it would be significant. CP1 would also include demolition and construction of recreational and public service facilities.

Relevant safety standards/procedures related to fire prevention would be incorporated into the project design, and would be used during construction activities and project operation and maintenance. Safety standards and procedures include the California Building Code; the Shasta County Fire Plan; USFS safety requirements regarding fire hazards; California Public Utilities Code General Order 95, which provides procedures for proper removal, disposal, and placement of poles, wires, and associated infrastructure; and the National Electric Safety Code (a voluntary code that provides safety procedures for electric utility installation and operation). Precautionary measures to prevent construction-related fires include locating utilities a safe distance from vegetation and structures, proper construction of power lines, and construction worker safety training. Postconstruction infrastructure operation and maintenance would follow current safety practices associated with fire prevention and would include clearing vegetation from power utility facilities and other sources using combustion engines (e.g., water pumps) on a regular basis.

Right-of-way easements obtained for transmission lines would be cleared of vegetation to provide for public and worker safety, and to provide reliable operations. The California Building Code, the National Electric Safety Code, and the Shasta County Fire Plan clearance requirements for power distribution facilities would be incorporated into the project design.

No new facilities or project construction would occur in the upper Sacramento River area. However, for purposes of the project, some aggregate material extraction may occur downstream from Shasta Dam. Construction activities downstream from Shasta Dam would increase the potential for fire starts due to the presence of highly flammable vegetation. In addition, vegetation below Shasta Dam would be susceptible to fires started elsewhere within the primary study area or surrounding areas.

Project materials and workers traveling to the construction sites from the upper Sacramento River area could also increase the risk of fire hazard over their route. Operation of motor vehicles throughout the region, particularly when vegetation adjacent to roadways is dry, imparts a certain level of fire potential from accidental combustion (e.g., sparks), hot metal (e.g., tail pipes, motors), or traffic accidents which could result in fire.

Project activities, including those intended to mitigate impacts on vegetation, are expected to reduce the overall fuel loading around the Shasta Lake and vicinity portion of the primary study area, thereby reducing the long-term fire hazard. In addition, the project could result in additional water supplies in the primary study area, which could assist future fire responses in the primary study area.

Project activities would increase the risk of wildland fires. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-2 (CP1): Release of Potentially Hazardous Materials or Hazardous Waste Project construction and operation would involve the transportation, use, or storage of hazardous materials. Local, State, and Federal safety codes and procedures related to hazardous material transport, handling, and disposal would be followed for project construction and operation to minimize the risk of a hazardous materials release. However, an accidental release resulting from project activities could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant.

Project facilities proposed for construction under CP1 would be located in the Shasta Lake and vicinity portion of the primary study area. Certain hazardous materials needed for construction and operation would need to be stored at the Shasta Dam facility and at other utility and infrastructure relocation sites around the primary study area. Certain hazardous materials would be used to operate equipment both during and after construction, and the construction, and operation, and maintenance of project facilities and infrastructure would require the use of potentially hazardous materials such as paint, concrete, and wood preservatives. In addition, industrial uses associated with the operation and maintenance of the modified Shasta Dam compound would require the use, storage, and routine transport of small quantities of hydraulic fluids, solvents, and other standard mechanical maintenance fluids.

Construction staging, and equipment and materials storage, including storage of possible contaminants, and equipment maintenance in the primary study area would occur in areas specified by Reclamation. Staging areas would likely be located in disturbed areas or existing facilities that would be inundated after the dam is raised, such as campgrounds, recreation parking facilities, the top of Shasta Dam, and the parking area along the left wing dam. All staging areas would be located at least 100 feet from bodies of water, wherever possible. Equipment refueling and maintenance would not occur within 100 feet of water bodies, wherever possible.

Seven existing gas/petroleum facilities would be subject to inundation under CP1 and would be relocated subsequent to demolition. The existing fuel tanks would be excavated and all associated piping would be removed. Hazardous material tests and removal would be performed, as required, in accordance with Title 23 CFR, Division 3, Chapter 16: Underground Tank Regulations, and in accordance with Shasta County Environmental Health Division requirements. In addition to adherence to the directives of Title 23, relocated tanks would be designed and constructed in accordance with the Uniform Fire Code; California Air Resources Board; Shasta County Development Standards, Section 6.7 (December 1997); and Shasta County Environmental Health Division requirements. Relocated tanks would be located in cleared areas with code-mandated clearances from other facilities.

Aggregate material for the project could originate from the drawdown portion of Shasta Lake and from areas downstream from Shasta Dam (e.g., Churn Creek bottom, Clear Creek confluence, Keswick Reservoir). These materials could contain hazardous substances such as mercury or selenium. Hazardous materials released into area waterways, including Shasta Lake and many upper Sacramento River tributaries, come from past land use activities (e.g., mining) or natural sources (e.g., asbestos, selenium) and are likely to be trapped in lake-bottom, river, or floodplain sediments.

Aggregate extraction could also require operation of heavy equipment next to and in Shasta Lake or the upper Sacramento River. Reclamation may use aggregate supplies from Shasta Lake or the upper Sacramento River floodplain for dam construction materials in the general vicinity of Bridge Bay Marina and Lakeshore Drive. Several additional aggregate sources near the existing shoreline of Shasta Lake are also being considered (e.g., Bass Mountain, Stillwater Creek valley, Gray Rocks). Excavation and extraction of aggregate from these sources, or the augmentation of gravel in the Sacramento River, would require the use of construction equipment, which would involve the use of various hazardous materials such as fuel, oils, grease, and other petroleum products. These contaminants could be introduced into water systems, either directly or through surface runoff.

Project implementation could result in dam operations that would inundate abandoned or inoperative mines located next to Shasta Lake. Areas adjacent to the Bully Hill/Rising Star property contain hazardous materials that would affect Shasta Lake. The effects of CP1 on mines in the primary study area and the upper Sacramento River are discussed in Chapter 7.

Four vehicle bridges would be removed under CP1: Charlie Creek Bridge, Doney Creek Bridge, McCloud River Bridge, and Didallas Creek Bridge. A fifth bridge, the Fender's Ferry Bridge, would be retained and modified to accommodate Shasta Dam raises. Bridge demolition or modification, as well as the demolition of other structures and facilities that would be inundated under CP1, could require handling of hazardous waste including asbestos, lead paint, and wood preservatives. This hazardous waste, along with any additional forms of hazardous waste materials generated by project construction, would be removed to an approved landfill for disposal per permit requirements. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers.

The environmental commitments for all action alternatives include the development and implementation of a construction management plan, erosion and sediment control plan, storm water pollution prevention plan, and revegetation plan, as well as water quality and fisheries conservation measures and compliance with all required permit terms and conditions. However, the accidental release of hazardous materials or waste could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-3 (CP1): Exposure of Workers to Hazardous Materials Project implementation could result in the exposure of workers to hazardous materials. The project would require the use of potentially hazardous materials to operate construction equipment and to construct various facilities. Reclamation and project contractors would follow local, State, and Federal regulations and procedures for properly transporting, handling, and storing hazardous materials and hazardous waste to decrease the risk of exposure; however, there is a possibility of accidents that could expose project workers to hazardous materials. Structures proposed for demolition, such as bridges, may contain asbestos, lead paint, toxic wood preservatives, or other hazardous substances. Fuel tanks and utility infrastructure (e.g., transformers containing PCBs) proposed for relocation also would involve some risk of exposure to hazardous substances. However, at this time it appears that the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant.

Project workers would be required to transport hazardous materials at various times, in various quantities, and for various stages of project development. I-5 and local roadways would be used to transport hazardous materials and hazardous waste to and from Shasta Lake and vicinity during construction and dam operations. Traffic accidents or equipment failure could expose project workers to hazardous materials. Reclamation and contractors would follow appropriate safety procedures to minimize these risks.

Project construction activities associated with utility line removal and relocation could expose workers to health risks associated with wood preservatives used on wooden utility poles and PCBs, which are commonly found in transformers. Approximately 53,600 feet (10.2 miles) of power and telecommunication lines and six power towers would be demolished and relocated to avoid inundation resulting from the proposed change in Shasta Lake’s elevation. A large number of wooden utility poles would be demolished and relocated outside of the inundation area. Construction activities associated with utility demolition and relocation are estimated to take up to 5 years. During that time, workers handling utility poles and transformers would follow protocols to minimize exposure to hazardous material and hazardous waste.

Aggregate extraction from sites in the primary study area that may contain hazardous materials entrained in sediments, such as mercury, could result in the exposure of workers to toxic substances. During construction, workers involved in gravel extraction activities would follow protocols to minimize exposure to hazardous materials.

Shasta Dam operations could expose workers at the facility to hazardous materials. Dam operations require the use of fuels, oils, greases, and solvents. Additional amounts of hazardous materials, beyond the volumes required for operation of the existing structure, may be needed to operate the expanded raised dam structure. Reclamation would update its HMBP and would ensure that its employees follow Cal/EPA and OSHA standards for handling hazardous waste.

In summary, the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-4 (CP1): Exposure of Sensitive Receptors to Hazardous Materials
Project implementation could expose sensitive receptors to hazardous materials

and waste that would be transported through the primary study area. A school and park, as well as numerous homes, are located in Shasta Lake City about 4 miles from Shasta Dam. Project activity would occur while school is in session, and the park is open to the public year round. Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant.

Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. Travel routes to and from the primary study area are limited (i.e., there are few roads); thus, construction traffic would have to use I-5 and local roads, such as Shasta Dam Boulevard and/or Lake Boulevard. A school and park, as well as numerous homes, are located in Shasta Lake City at the intersection of Shasta Dam Boulevard and Lake Boulevard, about 4 miles from Shasta Dam. Project activity would occur while school is in session. The park is open to the public year round. This park is the primary venue for a number of youth and adult sport programs.

Aside from scattered residential and recreation areas throughout the primary study area, it does not appear that any other sensitive receptors (e.g., hospitals, schools) in the primary study area would be placed at risk of exposure to hazardous materials as a result of the project. Project implementation would follow local, State, and Federal regulations and procedures regarding the transport of hazardous materials.

Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Haz-5 (CP1): Wildland Fire Risk No new facilities or project construction in the extended study area would affect the potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area via I-5. However, the typical quick response to traffic accidents and fires ignited along roadways significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant.

No new facilities or project construction would occur in the extended study area that would affect the existing potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area from outlying areas via I-5. The potential would exist for truck and vehicular traffic associated with the project to ignite a fire as the result of an accident, a spark, or overheating. However, traffic accidents and fires ignited along roadways typically receive quick local emergency assistance, which includes fire protection. This typical response significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and is thus not proposed.

Impact Haz-6 (CP1): Release of Potentially Hazardous Materials or Hazardous Waste No new facilities or project construction in the extended study area would result in the release of hazardous material or waste. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Therefore, this impact would be less than significant.

No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the release of hazardous material or waste. Although hazardous materials used for or generated by the project in the primary study area may be transported through the extended study area, the potential for their release into the environment is less than significant. Hazardous waste generated by the project in the primary study area would likely be disposed of in landfills in the extended study area, and would likely include utility poles, transformers, asbestos, or lead-based paint. Construction equipment would also generate petroleum product waste. Petroleum products would likely be reclaimed in the primary study area. Other hazardous waste would go to one of three EPA-certified commercial hazardous waste landfills in the state. They are all located in Kings, Kern, and Imperial counties.

Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Highly explosive hazardous waste and large amounts of liquid hazardous waste or are not anticipated to be transported out of the primary study area for disposal. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-7 (CP1): Exposure of Workers to Hazardous Materials Project implementation would not result in new facilities or construction in the extended study area. Hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Therefore, this impact would be less than significant.

Project implementation would not result in new facilities or construction in the extended study area. Workers may be required to transport hazardous materials through the extended study area for project purposes and could be exposed to the materials in the case of an accidental spill. However, hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Workers involved in hazardous waste disposal activities would follow Cal/EPA and

OSHA hazardous material and waste handling rules and regulations. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-8 (CP1): Exposure of Sensitive Receptors to Hazardous Materials or Hazardous Waste No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant.

Hazardous materials needed for construction or operation of the project and hazardous waste generated in the primary study area would be transported through the extended study area. Accidental spills of hazardous materials or waste during transport are possible; however, hazardous waste haulers and hazardous materials suppliers would adhere to all safety precautions and regulations pertaining to hazardous material and hazardous waste transport. These actions would minimize the risk of exposure to hazardous materials or hazardous waste by sensitive receptors in the extended study area. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Haz-1 (CP2): Wildland Fire Risk Project implementation could contribute to wildland fire risk. Project construction and operation, and the anticipated postconstruction human activity in the primary study area would increase the potential for fire ignition. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-1 (CP1). Activities that could result in wildland fire risks would be the same as those discussed for Impact Haz-1 (CP1). However, the larger inundation area proposed under CP2 would require that more utilities, public service, and recreational facilities be demolished and relocated than under CP1, and would require that more vegetation be cleared within the inundation area. The additional construction and mechanized vegetation clearing associated with CP2 would require prolonged operation of construction equipment in vegetated areas and increase the potential for fire ignition from motor vehicle operation and the presence of charged utility lines in areas with a high fire hazard potential. A proposed increase in the number of campground/day use recreation areas (261 versus 202 for CP1) would increase the potential for wildfire ignition. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-2 (CP2): Release of Potentially Hazardous Materials or Hazardous Waste Project construction and operation would involve the transportation, use, or storage of hazardous materials. Local, State, and Federal safety codes and procedures related to hazardous material transport, handling, and disposal would be followed for project construction and operation to minimize the risk of a hazardous materials release. However, an accidental release resulting from project activities could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-2 (CP1). However, the amount of potentially hazardous materials required for construction and operation of the project, and the volume of hazardous waste generated by project construction, could be greater for CP2 than for CP1. The number of bridge relocations, aggregate extraction or augmentation actions, and operations and maintenance of CP2 would be similar to but greater than those of CP1. Infrastructure relocation actions would require that land- and water-based construction and maintenance equipment operate in and adjacent to Shasta Lake and other potentially sensitive areas. Hazardous materials from leaking equipment, improper handling, or accidental spills could enter the lake, waterways, or adjacent land. Also under CP2, 10 gas/petroleum tanks would be excavated and relocated to avoid inundation. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-3 (CP2): Exposure of Workers to Hazardous Materials Project implementation could result in the exposure of workers to hazardous materials. The project would require the use of potentially hazardous materials to operate construction equipment and to construct various facilities. Reclamation and project contractors would follow local, State, and Federal regulations and procedures for properly transporting, handling, and storing hazardous materials and hazardous waste to decrease the risk of exposure; however, there is a possibility of accidents that could expose project workers to hazardous materials. Structures proposed for demolition, such as bridges, may contain asbestos, lead paint, toxic wood preservatives, or other hazardous substances. Fuel tanks and utility infrastructure (e.g., transformers containing PCBs) proposed for relocation also would involve some risk of exposure to hazardous substances. However, at this time it appears that the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-3 (CP1). CP2 would require the use of potentially hazardous materials during construction, operation, and maintenance of the project. The larger scale of CP2 compared to CP1 would also generate a larger volume of hazardous waste resulting from utility line and infrastructure demolition. However, workers involved in hazardous waste disposal activities would follow Cal/EPA and OSHA hazardous material and waste handling rules and regulations. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-4 (CP2): Exposure of Sensitive Receptors to Hazardous Materials Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. A school and park, as well as numerous homes, are located in Shasta Lake City about 4 miles from Shasta Dam. Project activity would occur while school is in session, and the park is open to the public year round. Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant.

This impact would be similar to Impact Haz-4 (CP1). Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. Travel routes to and from the primary study area are limited (i.e., there are few roads); thus, construction traffic would have to use I-5 and local roads, such as Shasta Dam Boulevard and/or Lake Boulevard. A school and park, as well as numerous homes are located in Shasta Lake City at the intersection of Shasta Dam Boulevard and Lake Boulevard, about 4 miles from Shasta Dam. Although the scale of project actions proposed under CP2 would be larger than that of CP1, the primary study area would remain the same. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Haz-5 (CP2): Wildland Fire Risk No new facilities or project construction in the extended study area would affect the potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area via I-5. However, the typical quick response to traffic accidents and fires ignited along roadways significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-5 (CP1). No new facilities or project construction would occur in the extended study area that would affect the existing potential for wildland fire. The potential for an increased risk of fire resulting from haul trucks associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-6 (CP2): Release of Potentially Hazardous Materials or Hazardous Waste No new facilities or project construction in the extended study area would result in the release of hazardous material or waste. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-6 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect release of hazardous material or waste. The potential for an increased risk of hazardous materials spills resulting from haul trucks associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-7 (CP2): Exposure of Workers to Hazardous Materials Project implementation would not result in new facilities or construction in the extended study area. Hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-7 (CP1). Project implementation would not result in new facilities or construction in the extended study area. Workers involved in hazardous waste disposal activities would follow Cal/EPA and OSHA hazardous material and waste handling rules and regulations. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-8 (CP2): Exposure of Sensitive Receptors to Hazardous Materials or Hazardous Waste No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-8 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect exposure of sensitive receptors to hazardous materials or hazardous waste. The potential for the exposure of sensitive receptors to hazard materials or waste associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Haz-1 (CP3): Wildland Fire Risk Project implementation could contribute to wildland fire risk. Project construction and operation, and the anticipated postconstruction human activity in the primary study area would increase the potential for fire ignition. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-1 (CP1). However, the larger inundation area proposed under CP2 would require that more utilities, public service, and recreational facilities be demolished and relocated than under CP1, and would require that more vegetation be cleared within the inundation area. The larger scale of utility line and road construction, and the vegetation clearing and grubbing associated with CP3 would require prolonged operation of construction equipment in vegetated areas and increase the potential for fire ignition that comes from motor vehicle operation and the presence of charged utility lines in areas with a high fire hazard potential. A proposed increase in the number of campground/day use recreation areas (328 versus 202 (CP1) or 261 (CP2)) would also increase the potential for wildfire ignition. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-2 (CP3): Release of Potentially Hazardous Materials or Hazardous Waste Project construction and operation would involve the transportation, use, or storage of hazardous materials. Local, State, and Federal safety codes and procedures related to hazardous material transport, handling, and disposal would be followed for project construction and operation to minimize the risk of a hazardous materials release. However, an accidental release resulting from project activities could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-2 (CP1). However, the amount of potentially hazardous materials required for construction and operation of the project and the volume of hazardous waste generated by project construction could be greater for CP3 than either CP1 or CP2. The number of bridge relocations, aggregate extraction or augmentation actions, and operations and maintenance of CP3 would be similar to but greater than those of CP1 and CP2. However, infrastructure relocation actions would require that land- and water-based construction and maintenance equipment operate in and adjacent to Shasta Lake and other potentially sensitive areas. Hazardous materials from leaking equipment, improper handling, or accidental spills could enter the lake, waterways, or adjacent land. Under CP3, 10 gas/petroleum tanks would be excavated and relocated to avoid inundation. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-3 (CP3): Exposure of Workers to Hazardous Materials Project implementation could result in the exposure of workers to hazardous materials. The project would require the use of potentially hazardous materials to operate construction equipment and to construct various facilities. Reclamation and project contractors would follow local, State, and Federal regulations and procedures for properly transporting, handling, and storing hazardous materials and hazardous waste to decrease the risk of exposure; however, there is a possibility of accidents that could expose project workers to hazardous materials. Structures proposed for demolition, such as bridges, may contain asbestos, lead paint, toxic wood preservatives, or other hazardous substances. Fuel tanks and utility infrastructure (e.g., transformers containing PCBs) proposed for relocation also would involve some risk of exposure to hazardous substances. However, at this time it appears that the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-3 (CP1). CP3 would require the use of potentially hazardous materials during construction, operation, and maintenance of the project. The larger scale of CP3 compared to CP1 or CP2 would also generate a larger volume of hazardous waste resulting from utility line demolition. However, workers involved in hazardous waste disposal activities would follow Cal/EPA and OSHA hazardous material and waste handling rules and regulations. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-4 (CP3): Exposure of Sensitive Receptors to Hazardous Materials Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. A school and park, as well as numerous homes, are located in Shasta Lake City about 4 miles from Shasta Dam. Project activity would occur while school is in session, and the park is open to the public year round. Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant.

This impact would be similar to Impact Haz-4 (CP1). Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. Travel routes to and from the primary study area are limited (i.e., there are few roads); thus, construction traffic would have to use I-5 and local roads, such as Shasta Dam Boulevard and/or Lake Street. A school and park, as well as numerous homes, are located in Shasta Lake City at the intersection of Shasta Dam Boulevard and Lake Boulevard, about 4 miles from Shasta Dam. Although the scale of project actions proposed under CP3 would be larger than that of CP1 or CP2, the primary study area would remain the same. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Haz-5 (CP3): Wildland Fire Risk No new facilities or project construction in the extended study area would affect the potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area via I-5. However, the typical quick response to traffic accidents and fires ignited along roadways significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-5 (CP1). No new facilities or project construction would occur in the extended study area that would affect the existing potential for wildland fire. The potential for an increased risk of fire resulting from haul trucks and construction traffic associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-6 (CP3): Release of Potentially Hazardous Materials or Hazardous Waste No new facilities or project construction in the extended study area would result in the release of hazardous material or waste. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-6 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect release of hazardous material or waste. The potential for an increased risk of hazardous materials spills resulting from haul trucks associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-7 (CP3): Exposure of Workers to Hazardous Materials Project implementation would not result in new facilities or construction in the extended study area. Hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-7 (CP1). Project implementation would not result in new facilities or construction in the extended study area. Workers involved in hazardous waste disposal activities would follow Cal/EPA and OSHA hazardous material and waste handling rules and regulations. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-8 (CP3): Exposure of Sensitive Receptors to Hazardous Materials or Hazardous Waste No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-8 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect exposure of sensitive receptors to hazardous materials or hazardous waste. The potential for the exposure of sensitive receptors to hazardous materials or waste associated with the project would be negligible.

Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Haz-1 (CP4): Wildland Fire Risk Project implementation could contribute to wildland fire risk. Project construction and operation, and the anticipated postconstruction human activity in the primary study area would increase the potential for fire ignition. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-1 (CP3), except that vehicles and equipment involved in the gravel augmentation activities and the Upper Sacramento River Potential Restoration Sites habitat restoration project would slightly increase the potential for wildland fires. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-2 (CP4): Release of Potentially Hazardous Materials or Hazardous Waste Project construction and operation would involve the transportation, use, or storage of hazardous materials. Local, State, and Federal safety codes and procedures related to hazardous material transport, handling, and disposal would be followed for project construction and operation to minimize the risk of a hazardous materials release. However, an accidental release resulting from project activities could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-2 (CP3), except that vehicles and equipment involved in the gravel augmentation activities and Upper Sacramento River Potential Restoration Sites would slightly increase the potential for release of hazardous materials or waste.

Under CP4, the major components described for CP3 would be implemented, but the project focus would be on increasing habitat for anadromous fish. Gravel may be augmented at points along the Sacramento River downstream from Shasta Dam to create fish habitat. Aggregate extraction and/or augmentation activities under CP4 could release hazardous substances (e.g., mercury) entrained in these gravels into the water. Also, gravel augmentation and the Upper Sacramento River Potential Restoration Sites habitat restoration project could cause hazardous materials from leaking equipment, improper handling, or accidental spills could enter nearby waterways or adjacent land. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-3 (CP4): Exposure of Workers to Hazardous Materials Project implementation could result in the exposure of workers to hazardous materials.

The project would require the use of potentially hazardous materials to operate construction equipment and to construct various facilities. Reclamation and project contractors would follow local, State, and Federal regulations and procedures for properly transporting, handling, and storing hazardous materials and hazardous waste to decrease the risk of exposure; however, there is a possibility of accidents that could expose project workers to hazardous materials. Structures proposed for demolition, such as bridges, may contain asbestos, lead paint, toxic wood preservatives, or other hazardous substances. Fuel tanks and utility infrastructure (e.g., transformers containing PCBs) proposed for relocation also would involve some risk of exposure to hazardous substances. However, at this time it appears that the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-3 (CP3), except that gravel augmentation activities and the Upper Sacramento River Potential Restoration Sites habitat restoration project would slightly increase the potential for the exposure of workers to hazardous materials or hazardous waste. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-4 (CP4): Exposure of Sensitive Receptors to Hazardous Materials Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. A school and park, as well as numerous homes, are located in Shasta Lake City about 4 miles from Shasta Dam. Project activity would occur while school is in session, and the park is open to the public year round. Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant.

This impact would be similar to Impacts Haz-4 (CP1) and Haz-4 (CP3). Under CP4, the major components described for CP3 would be implemented, but the project focus would be on increasing habitat for anadromous fish. No additional actions are proposed that would affect the potential for the exposure of sensitive receptors to hazardous materials or hazardous waste. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Haz-5 (CP4): Wildland Fire Risk No new facilities or project construction in the extended study area would affect the potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area via I-5. However, the typical quick response to traffic accidents and fires ignited along roadways significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-5 (CP1). No new facilities or project construction would occur in the extended study area that would affect the existing potential for wildland fire. The potential for an increased risk of fire resulting from haul trucks or construction traffic associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-6 (CP4): Release of Potentially Hazardous Materials or Hazardous Waste No new facilities or project construction in the extended study area would result in the release of hazardous material or waste. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-6 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect release of hazardous material or waste. The potential for an increased risk of hazardous materials spills resulting from haul trucks associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-7 (CP4): Exposure of Workers to Hazardous Materials Project implementation would not result in new facilities or construction in the extended study area. Hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-7 (CP1). Project implementation would not result in new facilities or construction in the extended study area. Workers involved in hazardous waste disposal activities would follow Cal/EPA and OSHA hazardous material and waste handling rules and regulations. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-8 (CP4): Exposure of Sensitive Receptors to Hazardous Materials or Hazardous Waste No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-8 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect exposure of sensitive receptors to hazardous materials or hazardous waste. The potential for the exposure of sensitive receptors to hazard materials or waste associated with the project would be negligible. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

Shasta Lake and Vicinity and Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Haz-1 (CP5): Wildland Fire Risk Project implementation could contribute to wildland fire risk. Project construction and operation, and the anticipated postconstruction human activity in the primary study area would increase the potential for fire ignition. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-1 (CP4). This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-2 (CP5): Release of Potentially Hazardous Materials or Hazardous Waste Project construction and operation would involve the transportation, use, or storage of hazardous materials. Local, State, and Federal safety codes and procedures related to hazardous material transport, handling, and disposal would be followed for project construction and operation to minimize the risk of a hazardous materials release. However, an accidental release resulting from project activities could expose the public and the environment to a significant safety hazard. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Haz-2 (CP4). Under CP5, the major components described for CP3 would be implemented, but as described under CP4, the project focus would be a combination of increasing water supply availability, enhancing environmental resources in the primary study area, and maintaining the existing level of recreational opportunities. No additional actions are proposed that would affect the potential for the release of hazardous materials or hazardous waste. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Impact Haz-3 (CP5): Exposure of Workers to Hazardous Materials Project implementation could result in the exposure of workers to hazardous materials. The project would require the use of potentially hazardous materials to operate construction equipment and to construct various facilities. Reclamation and project contractors would follow local, State, and Federal regulations and procedures for properly transporting, handling, and storing hazardous materials and hazardous waste to decrease the risk of exposure; however, there is a possibility of accidents that could expose project workers to hazardous materials. Structures proposed for demolition, such as bridges, may contain asbestos, lead paint, toxic wood preservatives, or other hazardous substances. Fuel tanks and utility infrastructure (e.g., transformers containing PCBs) proposed for relocation also would involve some risk of exposure to hazardous substances. However, at this time it appears that the quantities and types of hazardous materials and possible exposure levels to these materials in the workplace would not pose a significant risk to worker health and safety. Furthermore, there are no known hazardous waste sites in the primary study area. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-3 (CP3). Under CP5, the major components described for CP3 would be implemented, but the project focus would be a combination of increasing water supply availability, enhancing environmental resources in the primary study area, and maintaining the existing level of recreational opportunities. No additional actions are proposed that would affect the potential for the exposure of workers to hazardous materials or hazardous waste. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-4 (CP5): Exposure of Sensitive Receptors to Hazardous Materials Project implementation could expose sensitive receptors to hazardous materials and waste that would be transported through the primary study area. A school and park, as well as numerous homes, are located in Shasta Lake City about 4 miles from Shasta Dam. Project activity would occur while school is in session, and the park is open to the public year round. Although Reclamation would implement measures to lessen the risk of hazardous materials exposure to sensitive receptors, this impact would be potentially significant.

This impact would be similar to Impact Haz-4 (CP3). Under CP5, the major components described for CP3 would be implemented, but the project focus would be a combination of increasing water supply availability, enhancing environmental resources in the primary study area, and maintaining the existing level of recreational opportunities. No additional actions are proposed that would affect the potential for the exposure of sensitive receptors to hazardous materials or hazardous waste. This impact would be potentially significant. Mitigation for this impact is proposed in Section 9.3.5.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Haz-5 (CP5): Wildland Fire Risk No new facilities or project construction in the extended study area would affect the potential for wildland fire. Construction materials would be transported and workers would travel to the extended study area via I-5. However, the typical quick response to traffic accidents and fires ignited along roadways significantly decreases the potential for a wildland fire being accidentally ignited by project-related traffic. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-5 (CP1). No new facilities or project construction would occur in the extended study area that would affect the existing potential for wildland fire. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-6 (CP5): Release of Potentially Hazardous Materials or Hazardous Waste No new facilities or project construction in the extended study area would result in the release of hazardous material or waste. Transport of hazardous materials would be conducted in accordance with CCR Title 26 and would be licensed by the CHP, pursuant to California Vehicle Code Section 32000, which requires proper packaging and licensing by hazardous materials haulers and approved by Caltrans. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-6 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect release of hazardous material or waste. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-7 (CP5): Exposure of Workers to Hazardous Materials Project implementation would not result in new facilities or construction in the extended study area. Hazardous material transport and safety procedures for hazardous material transported through the extended study area would be sufficient to minimize risks to workers. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-7 (CP1). Project implementation would not result in new facilities or construction in the extended study area. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Haz-8 (CP5): Exposure of Sensitive Receptors to Hazardous Materials or Hazardous Waste No new facilities or project construction would occur in the extended study area that would directly or indirectly result in the exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant.

This impact would be similar to Impact Haz-8 (CP1). No new facilities or project construction would occur in the extended study area that would result in the direct or indirect exposure of sensitive receptors to hazardous materials or hazardous waste. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

9.3.5 Mitigation Measures

Table 9-1 presents a summary of mitigation measures for hazards and hazardous materials and waste.

Table 9-1. Summary of Mitigation Measures for Hazards and Hazardous Materials and Waste

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact Haz-1: Wildland Fire Risk (Shasta Lake and Vicinity and Upper Sacramento River)	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Haz-1: Coordinate and Assist Public Services Agencies to Reduce Fire Hazards.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-2: Release of Potentially Hazardous Materials or Hazardous Waste (Shasta Lake and Vicinity and Upper Sacramento River)	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Haz-2: Reduce Potential for Release of Hazardous Materials and Waste.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-3: Exposure of Workers to Hazardous Materials (Shasta Lake and Vicinity and Upper Sacramento River)	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-4: Exposure of Sensitive Receptors to Hazardous Materials (Shasta Lake and Vicinity and Upper Sacramento River)	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Haz-4: Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-5: Wildland Fire Risk (Lower Sacramento River, Delta, CVP/SWP Service Areas)	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-6: Release of Potentially Hazardous Materials or Hazardous Waste (Lower Sacramento River, Delta, CVP/SWP Service Areas)	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-7: Exposure of Workers to Hazardous Materials (Lower Sacramento River, Delta, CVP/SWP Service Areas)	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Haz-8: Exposure of Sensitive Receptors to Hazardous Materials (Lower Sacramento River, Delta, CVP/SWP Service Areas)	LOS before Mitigation	NI	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS

Key:
LOS = level of significance
LTS = less than significant
NI = no impact
PS = potentially significant

No-Action Alternative

No mitigation measures are required for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is required for Impact Haz-3 (CP1) or Impacts Haz-5 (CP1) through Haz-8 (CP1). Mitigation is provided below for other impacts of CP1 on hazards and hazardous materials. Mitigation is provided for the wildland fire hazard, the risk of hazardous material or hazardous waste releases, and the risk of exposing sensitive receptors to hazardous materials.

Mitigation Measure Haz-1 (CP1): Coordinate and Assist Public Services Agencies to Reduce Fire Hazards Reclamation will coordinate all proposed road closures, detours, and traffic control measures with SCSO and the Tehama County Sheriff's Office, which are the designated offices of emergency services for the primary study area.

Reclamation will also coordinate all proposed road closures, detours, and traffic control measures with USFS, Caltrans, the CHP, the City of Shasta Lake, and the surrounding Shasta Lake communities.

Reclamation will appoint a public liaison to communicate construction schedules, road closures, and project activities with the public. The liaison will organize and conduct public meetings for communicating project information. The liaison will meet with all affected public services agencies to coordinate public meetings and information exchanges.

Reclamation will meet with public services agencies to determine that traffic controls for infrastructure, utility, and structure relocation do not impede emergency access for wildland fire response capabilities.

Reclamation will require that all project workers receive fire prevention safety training, which identifies local wildland fire hazards and informs workers of the relevant fire prevention procedures, rules, and regulations.

Implementation of this mitigation measure would reduce Impact Haz-1 (CP1) to a less-than-significant level.

Mitigation Measure Haz-2 (CP1): Reduce Potential for Release of Hazardous Materials and Waste Reclamation will update the Shasta Dam facilities HMBP (or like document). The update will provide information regarding the hazardous materials used for project implementation and hazardous waste that would be generated.

Reclamation will coordinate hazardous materials and waste information with SCSO and the Tehama County Sheriff's Office (the designated offices of emergency services for the primary study area), USFS, the City of Shasta Lake, and the surrounding Shasta Lake communities. Transportation coordination efforts will also include the CHP and Caltrans, and will include disclosing and planning proposed hazardous material transportation routes to ensure use of the route(s) having the least impact.

Reclamation will appoint a public liaison to communicate hazardous material transportation routes related to project activities with the public. The liaison will organize and conduct public meetings, which will include discussions of hazardous waste transport in the primary and extended study areas. The liaison will meet with all affected public services agencies to coordinate public meetings and information exchanges.

Project workers who may come into contact with hazardous materials or waste will be required to receive hazardous material safety training, which identifies hazardous materials on the project site and informs workers of the relevant safety procedures, rules, and regulations that address hazardous waste handling, storage, and transportation.

Reclamation will ensure that project construction sites have staging areas that minimize potential hazardous waste releases and that meet best management practices for short-term construction site hazardous material storage.

Implementation of this mitigation measure would reduce Impact Haz-2 (CP1) to a less-than-significant level.

Mitigation Measure Haz-4 (CP1): Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste Reclamation will coordinate hazardous materials transportation routes with SCSO and the Tehama County Sheriff's Office (which are the designated offices of emergency services for the primary study area), USFS, Caltrans, CHP, the City of Shasta Lake, a representative from the Shasta Lake Elementary School, and each county office of emergency services that would be affected in the primary and extended study areas. Coordination efforts will include disclosing and planning proposed hazardous material transportation routes and schedules to allow for site-specific modifications that would lessen the potential impact on sensitive receptors.

Reclamation will appoint a public liaison to communicate hazardous material transportation routes related to project activities with the public. The liaison will organize and conduct public meetings, which will include a discussion of hazardous waste transport near local sensitive receptors. The liaison will meet with all affected public services agencies to coordinate public meetings and information exchanges.

Reclamation will identify sensitive receptor sites for all project workers who would use, handle, or transport hazardous materials, and require workers transporting hazardous materials past the sensitive receptors to proceed with extreme caution.

Reclamation will place road signs identifying sensitive receptor sites for hazardous material haulers and post reduced speed limits if local jurisdictions find it necessary to prevent potential impacts.

Implementation of this mitigation measure would reduce Impact Haz-4 (CP1) to a less-than-significant level.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is required for Impact Haz-3 (CP2) or Impacts Haz-5 (CP2) through Haz-8 (CP2). Mitigation is provided below for other impacts of CP2 on hazards and hazardous materials. Mitigation is provided for the wildland fire hazard, the risk of hazardous material or hazardous waste releases, and the risk of exposing sensitive receptors to hazardous materials.

Mitigation Measure Haz-1 (CP2): Coordinate and Assist Public Services Agencies to Reduce Fire Hazards This mitigation measure is identical to Mitigation Measure Haz-1 (CP1). Implementation of this mitigation measure would reduce Impact Haz-1 (CP2) to a less-than-significant level.

Mitigation Measure Haz-2 (CP2): Reduce Potential for Release of Hazardous Materials and Waste This mitigation measure is identical to Mitigation Measure Haz-2 (CP1). Implementation of this mitigation measure would reduce Impact Haz-2 (CP2) to a less-than-significant level.

Mitigation Measure Haz-4 (CP2): Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste This mitigation measure is identical to Mitigation Measure Haz-4 (CP1). Implementation of this mitigation measure would reduce Impact Haz-4 (CP2) to a less-than-significant level.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

No mitigation is required for Impact Haz-3 (CP3) or Impacts Haz-5 (CP3) through Haz-8 (CP3). Mitigation is provided below for other impacts of CP3 on hazards and hazardous materials. Mitigation is provided for the wildland fire hazard, the risk of hazardous material or hazardous waste releases, and the risk of exposing sensitive receptors to hazardous materials.

Mitigation Measure Haz-1 (CP3): Coordinate and Assist Public Services Agencies to Reduce Fire Hazards This mitigation measure is identical to Mitigation Measure Haz-1 (CP1). Implementation of this mitigation measure would reduce Impact Haz-1 (CP3) to a less-than-significant level.

Mitigation Measure Haz-2 (CP3): Reduce Potential for Release of Hazardous Materials and Waste This mitigation measure is identical to Mitigation Measure Haz-2 (CP1). Implementation of this mitigation measure would reduce Impact Haz-2 (CP3) to a less-than-significant level.

Mitigation Measure Haz-4 (CP3): Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste This mitigation measure is identical to Mitigation Measure Haz-4 (CP1). Implementation of this mitigation measure would reduce Impact Haz-4 (CP3) to a less-than-significant level.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation is required for Impact Haz-3 (CP4) or Impacts Haz-5 (CP4) through Haz-8 (CP4). Mitigation is provided below for other impacts of CP4 on hazards and hazardous materials. Mitigation is provided for the wildland fire hazard, the risk of hazardous material or hazardous waste releases, and the risk of exposing sensitive receptors to hazardous materials.

Mitigation Measure Haz-1 (CP4): Coordinate and Assist Public Services Agencies to Reduce Fire Hazards This mitigation measure is identical to Mitigation Measure Haz-1 (CP1). Implementation of this mitigation measure would reduce Impact Haz-1 (CP4) to a less-than-significant level.

Mitigation Measure Haz-2 (CP4): Reduce Potential for Release of Hazardous Materials and Waste This mitigation measure is identical to Mitigation Measure Haz-2 (CP1). Implementation of this mitigation measure would reduce Impact Haz-2 (CP4) to a less-than-significant level.

Mitigation Measure Haz-4 (CP4): Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste This mitigation measure is identical to Mitigation Measure Haz-4 (CP1). Implementation of this mitigation measure would reduce Impact Haz-4 (CP4) to a less-than-significant level.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is required for Impact Haz-3 (CP5) or Impacts Haz-5 (CP5) through Haz-8 (CP5). Mitigation is provided below for other impacts of CP5 on hazards and hazardous materials. Mitigation is provided for the wildland fire hazard, the risk of hazardous material or hazardous waste releases, and the risk of exposing sensitive receptors to hazardous materials.

Mitigation Measure Haz-1 (CP5): Coordinate and Assist Public Services Agencies to Reduce Fire Hazards This mitigation measure is identical to Mitigation Measure Haz-1 (CP1). Implementation of this mitigation measure would reduce Impact Haz-1 (CP5) to a less-than-significant level.

Mitigation Measure Haz-2 (CP5): Reduce Potential for Release of Hazardous Materials and Waste This mitigation measure is identical to Mitigation Measure Haz-2 (CP1). Implementation of this mitigation measure would reduce Impact Haz-2 (CP5) to a less-than-significant level.

Mitigation Measure Haz-4 (CP5): Reduce Potential for Exposure of Sensitive Receptors to Hazardous Materials or Waste This mitigation measure is identical to Mitigation Measure Haz-4 (CP1). Implementation of this mitigation measure would reduce Impact Haz-4 (CP5) to a less-than-significant level.

9.3.6 Cumulative Effects

Potentially significant effects were identified in the areas of increased wildland fire risk, accidental releases of hazardous materials or hazardous waste, and potential exposure of sensitive receptors to hazardous materials or hazardous waste. The potential effects would be of greater magnitude and duration with the larger dam raises (i.e., CP3 through CP5 would have greater potential effects than CP1 and CP2).

Reasonably foreseeable actions in the Shasta Lake and vicinity area, such as the construction of Antlers Bridge or the Iron Mountain Mine Restoration Plan, may result in increased potential for wildland fire hazards or accidental releases of hazardous materials or hazardous waste within the primary study area. In addition, as described in the Climate Change Projection Appendix, climate change could result in less precipitation through the 2050s and warmer air temperature, thereby increasing the risk of wildland fire hazard in the vicinity of Shasta Lake.

Implementation of the proposed SLWRI alternatives would result in potentially significant impacts to wildland fire hazards, accidental releases of hazardous materials or hazardous waste, and exposure of sensitive receptors to hazardous materials or hazardous waste. Additive and interactive/multiplicative effects of implementing the proposed SLWRI alternatives with past, present, and reasonably foreseeable probable future projects could result in cumulatively considerable impacts. However, mitigation would be used to reduce impacts associated with the project to a less-than-significant level. Therefore, the potential for project-related impacts to be cumulatively considerable after mitigation would be less than significant.

The exposure of workers to hazards, hazardous materials, or hazardous waste would not be a cumulatively considerable effect. Implementation of the proposed SLWRI alternatives would not be likely to involve the same workers or occur in the same place or time. Therefore, project implementation would not likely be associated with significant cumulative effects in terms of exposing workers and other sensitive receptors to hazards, hazardous materials, or hazardous waste.