7. Surface Water Quality

7.1 Introduction

This chapter describes the existing conditions (the environmental setting) and Sites Reservoir Project (Project)-related changes to surface water quality of reservoirs and rivers for the Extended, Secondary, and Primary study areas. Descriptions and maps of these three study areas are provided in Chapter 1 Introduction. An overview of surface waters in the Extended, Secondary, and Primary study areas is presented in Section 6.2 of Chapter 6 Surface Water Resources.

Permits and authorizations for surface water quality are presented in Chapter 4 Environmental Compliance and Permit Summary. The regulatory setting for surface water quality is presented in Appendix 4A Environmental Compliance. This chapter also includes a description of water quality constituents of concern that could be affected by implementation of the Project.

As described in Chapter 6 Surface Water Resources, implementation of the action alternatives results in stream flow changes downstream of the Central Valley Project (CVP) and State Water Project (SWP) reservoirs in the Trinity River and Sacramento River watersheds, and along the Sacramento River from Red Bluff to Verona as compared to the Existing Conditions/No Project/No Action Condition in the Extended, Secondary, and Primary study areas. These changes in flow could affect surface water quality downstream of the reservoirs. However, as described in Chapter 6 Surface Water Resources, implementation of the action alternatives would not result in stream flow changes to the following water bodies compared to the Existing Conditions/No Project/No Action Condition:

- Upstream of all CVP and SWP reservoirs
- Upstream or downstream of existing non-CVP and non-SWP reservoirs
- Upstream or downstream of the CVP New Melones Reservoir on the Stanislaus River and the CVP Millerton Lake on San Joaquin River
- On surface waters in the San Francisco Bay Area, Central Coast, and Southern California regions

Therefore, surface water quality conditions are not analyzed for these water bodies or for water supplies diverted from these water bodies. Potential impacts from constructing, operating, and maintaining the alternatives are described and compared to applicable significance thresholds.

Descriptions of changes in reservoir and stream temperatures and associated environmental effects of these changes under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) are more related to conditions of aquatic resources (Chapter 12 Aquatic Biological Resources). Accordingly, this chapter includes a discussion of beneficial uses affected by water temperatures. However, specific impact analyses related to changes in aquatic resources resulting from temperature changes are provided in Chapter 12 Aquatic Biological Resources. Anticipated impacts with regard to other constituents are presented below.

7.2 Environmental Setting/Affected Environment

7.2.1 Overview of Surface Water Quality Objectives

Surface water quality in the Extended, Secondary, and Primary study areas is dependent upon local geology, discharges from point and non-point sources, and regulatory criteria. Actions located on public agency lands or implemented, funded, or approved by federal and state agencies would need to be compliant with appropriate federal and state agency policies and regulations, as summarized in Chapter 4 Environmental Compliance and Permit Summary. Several of the federal and state laws and regulations that directly affect water quality include the Federal Water Pollution Control Act Amendments of 1972, also known as the Clean Water Act (CWA). The CWA established the institutional structure for the U.S. Environmental Protection Agency (USEPA) to regulate discharges of pollutants into the waters of the United States, establish water quality standards, conduct planning studies, and provide funding for specific grant projects. The CWA was further amended through the CWA of 1977 and the Water Quality Act of 1987. The California State Water Resources Control Board (SWRCB) has been designated by USEPA to develop and enforce water quality objectives and implementation plans in California.

The California Regional Water Quality Control Boards (RWQCBs) have adopted, and the SWRCB has approved, water quality control plans (basin plans) for each watershed basin in the State. The basin plans designate the beneficial uses of waters within each watershed basin and water quality objectives designed to protect those uses pursuant to Section 303 of the CWA. The beneficial uses together with the water quality objectives that are contained in the basin plans constitute State water quality standards. The beneficial uses for the watershed basins in the Extended, Secondary, and Primary study areas are presented in Table 7-1.

Under the CWA Section 303(d), USEPA identifies and ranks water bodies for which existing pollution controls are insufficient to attain or maintain water quality standards based upon information prepared by all states, territories, and authorized Indian tribes (referred to collectively as “states” in the CWA). This list of impaired waters for each state comprises the state’s Section 303(d) list. Each state must establish priority rankings and develop total maximum daily load (TMDL) values for all impaired waters. TMDLs calculate the greatest pollutant load that a water body can receive and still meet water quality standards and designated beneficial uses. As presented in Appendix 7A California State Water Resources Control Board Constituents of Concern of Water Bodies in the Study Area, TMDLs have been adopted or will be adopted by 2030. The SWRCB anticipates that implementation of these TMDLs will achieve the stated goals to improve water quality in the impaired waters.

The Project will primarily affect water quality in the Extended, Secondary, and Primary study areas through changes in flow patterns and quantities in the Trinity River and Sacramento River watersheds and in San Luis Reservoir. The water quality constituents that could be most affected by these changes are water temperature and levels of salinity, mercury, selenium, other heavy metals, nutrients, pathogens, dissolved oxygen, and organic carbon. These constituents are briefly described in Sections 7.2.1.1 through 7.2.1.9.

7.2.1.1 *Water Temperature*

Water temperature is a concern in regions throughout California, including the lower Klamath River, Trinity Lake, Sacramento River, and the San Joaquin River. These regions support warm and cold fresh water habitat and other aquatic beneficial uses. Water bodies in these areas must maintain water temperatures supportive of resident and seasonal fish species habitats, particularly for endangered species.

Table 7-1
Designated Beneficial Uses within the Extended, Secondary, and Primary Study Areas

Surface Water Body	Municipal and Domestic Supply (MUN)	Agricultural Supply (AGR)	Industrial Service Supply (IND)	Industrial Process Supply (PRO)	Groundwater Recharge (GWR)	Fresh Water Replenishment (FRSH)	Navigation (NAV)	Hydropower Generation (POW)	Water Contact Recreation (REC-1)	Non-contact Water Recreation (REC-2)	Commercial and Sport Fishing (COMM)	Warm Fresh Water Habitat (WARM)	Cold Fresh Water Habitat (COLD)	Wildlife Habitat (WILD)	Rare, Threatened, or Endangered Species (RARE)	Marine Habitat (MAR)	Migration of Aquatic Organisms (MIGR)	Spawning, Reproduction, and/or Early Development (SPWN)	Shellfish Harvesting (SHELL)	Estuarine Habitat (EST)	Aquaculture (AQUA)	Native American Culture (CUL)	Flood Peak Attenuation/Flood Water Storage (FLD)	Wetland Habitat (WET)	Water Quality Enhancement (WQE)
Trinity and Lower Klamath Rivers																									
Lower Klamath River and Klamath Glen Hydrologic Subarea	E	E	P	P	E	E	E	P	E	E	E	E	E	E	E	E	E	E	E	E	P	E	–	–	–
Trinity Lake	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	–	P	E	–	–	P	–	–	–	–
Lewiston Reservoir	E	E	P	P	E	E	E	E	E	E	E	P	E	E	E	–	P	E	–	–	E	–	–	–	–
Middle Trinity River and Surrounding Hydrologic Area	E	E	E	P	E	E	E	P	E	E	E	–	E	E	E	–	E	E	–	–	E&P	–	–	–	–
Lower Trinity River and Surrounding Hydrologic Area[a]	E&P	E&P	E	E&P	E	E	E	E&P	E	E	E	–	E	E	E	–	E	E	P	–	E&P	E[b]	–	–	–
Sacramento River Basin																									
Shasta Lake	E	E	–	–	–	–	–	E	E	E	–	E[d]	E[d]	E	–	–	–	E[e,f]	–	–	–	–	–	–	–
Sacramento River: Shasta Dam to Colusa Basin Drain	E	E	E	–	–	–	E	E	E[c]	E	–	E[d]	E[d]	E	–	–	E[e,f]	E[e,f]	–	–	–	–	–	–	–
Colusa Basin Drain	–	E	–	–	–	–	–	–	E[c]	–	–	E[d]	P[d]	E	–	–	E[f]	E[f]	–	–	–	–	–	–	–

Surface Water Body	Municipal and Domestic Supply (MUN)	Agricultural Supply (AGR)	Industrial Service Supply (IND)	Industrial Process Supply (PRO)	Groundwater Recharge (GWR)	Fresh Water Replenishment (FRSH)	Navigation (NAV)	Hydropower Generation (POW)	Water Contact Recreation (REC-1)	Non-contact Water Recreation (REC-2)	Commercial and Sport Fishing (COMM)	Warm Fresh Water Habitat (WARM)	Cold Fresh Water Habitat (COLD)	Wildlife Habitat (WILD)	Rare, Threatened, or Endangered Species (RARE)	Marine Habitat (MAR)	Migration of Aquatic Organisms (MIGR)	Spawning, Reproduction, and/or Early Development (SPWN)	Shellfish Harvesting (SHELL)	Estuarine Habitat (EST)	Aquaculture (AQUA)	Native American Culture (CUL)	Flood Peak Attenuation/Flood Water Storage (FLD)	Wetland Habitat (WET)	Water Quality Enhancement (WQE)
Sacramento River: Colusa Basin Drain to Eye ("I") Street Bridge	E	E	–	–	–	–	E	–	E[c]	E	–	E[d]	E[d]	E	–	–	E[e,f]	E[e,f]	–	–	–	–	–	–	–
Whiskeytown Lake	E	E	–	–	–	–	–	E	E	E	–	E[d]	E[d]	E	–	–	–	E[f]	–	–	–	–	–	–	–
Clear Creek below Whiskeytown Lake	E	E	–	–	–	–	–		E[c]	E	–	E[d]	E[d]	E	–	–	E[e]	E[e,f]	–	–	–	–	–	–	–
Feather River below Lake Oroville (Fish Barrier Dam to Sacramento River)	E	E	–	–	–	–	–	–	E[c]	E	–	E[d]	E[d]	E	–	–	E[e,f]	E[e,f]	–	–	–	–	–	–	–
American River below Lake Natoma (Folsom Dam to Sacramento River)	E	E	E	–	–	–	–	E	E[c]	E	–	E[d]	E[d]	E	–	–	E[e,f]	E[e,f]	–	–	–	–	–	–	–
Yolo Bypass[g]	–	E	–	–	–	–	–	–	E	E	–	E[d]	P[d]	E	–	–	E[e,f]	E[f]	–	–	–	–	–	–	–
Sacramento-San Joaquin River Delta																									
Sacramento-San Joaquin River Delta[g,h,i]	E	E	E	E	E	–	E	–	E	E	E	E[d]	E[d]	E	E	–	E[e,f]	E[f]	E	E	–	–	–	–	–

Surface Water Body	Municipal and Domestic Supply (MUN)	Agricultural Supply (AGR)	Industrial Service Supply (IND)	Industrial Process Supply (PRO)	Groundwater Recharge (GWR)	Fresh Water Replenishment (FRSH)	Navigation (NAV)	Hydropower Generation (POW)	Water Contact Recreation (REC-1)	Non-contact Water Recreation (REC-2)	Commercial and Sport Fishing (COMM)	Warm Fresh Water Habitat (WARM)	Cold Fresh Water Habitat (COLD)	Wildlife Habitat (WILD)	Rare, Threatened, or Endangered Species (RARE)	Marine Habitat (MAR)	Migration of Aquatic Organisms (MIGR)	Spawning, Reproduction, and/or Early Development (SPWN)	Shellfish Harvesting (SHELL)	Estuarine Habitat (EST)	Aquaculture (AQUA)	Native American Culture (CUL)	Flood Peak Attenuation/Flood Water Storage (FLD)	Wetland Habitat (WET)	Water Quality Enhancement (WQE)
San Joaquin River Basin																									
San Luis Reservoir	E	E	E	–	–	–	–	E	E	E	–	E[d]	–	E	–	–	–	–	–	–	–	–	–	–	–
O'Neill Reservoir	E	E	–	–	–	–	–	–	E	E	–	E[d]	–	–	–	–	–	–	–	–	–	–	–	–	–
California Aqueduct	E	E	E	E	–	–	–	E	E	E	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–
Delta-Mendota Canal	E	E	–	–	–	–	–	–	E	E	–	E[d]	–	E	–	–	–	–	–	–	–	–	–	–	–

[a]Includes beneficial uses for the Trinity River within the Hoopa Valley Indian Reservation as designated by the Hoopa Valley Indian Reservation Water Quality Control Plan, which, in addition to beneficial uses shown, also designates the Lower Trinity River as a Wild and Scenic waterway, providing for scenic, fisheries, wildlife, and recreational purposes.

[b]Not all beneficial uses are present uniformly throughout this water body. They have been summarized to reflect beneficial uses present in multiple segments of the water body.

[c]Canoeing and rafting included in REC-1 designation.

[d]Resident does not include anadromous. Segments with both COLD and WARM beneficial use designations will be considered cold-water bodies for the application of water quality objectives.

[e]Cold-water protection for salmon and steelhead.

[f]Warm-water protection for striped bass, sturgeon, and shad.

[g]Beneficial uses vary throughout the Delta and will be evaluated on a case-by-case basis. COMM is a designated beneficial use for the Sacramento-San Joaquin Delta and Yolo Bypass waterways listed in Appendix 43 of the Basin Plan for the Sacramento River and San Joaquin River Basins and not tributaries to the listed waterways or portions of the listed waterways outside of the legal Delta boundary unless specifically designated.

[h]Delta beneficial uses are shown as designated by the Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin, and the Water Quality Control Plan for the San Francisco Bay/Sacramento San Joaquin Delta Estuary.

[i]Per State Water Board Resolution No. 90-28, Marsh Creek and Marsh Creek Reservoir in Contra Costa County are assigned the following beneficial uses: REC-1 and REC-2 (potential uses), WARM, WILD, and RARE. COMM is a designated beneficial use for Marsh Creek and its tributaries listed in Appendix 43 of the Basin Plan for the Sacramento River and San Joaquin River Basins within the legal Delta boundary.

Notes:

E = Existing Beneficial Use
P = Potential Beneficial Use

Sources: SWRCB, 2006a; Hoopa Valley Tribal Environmental Protection Agency (TEPA), 2008; Central Valley Regional Water Quality Control Board (CVRWQCB), 2011; North Coast Regional Water Quality Control Board (NCRWQCB), 2011

Common narrative and numeric water quality objectives for water temperature in water bodies within the Extended, Secondary, and Primary study areas are specified in each of the basin plans for the North Coast, Central Valley, Tulare Lake, and the San Francisco Bay regions (North Coast RWQCB [NCRWQCB], 2011; Central Valley RWQCB [CVRWQCB], 2004, 2016; San Francisco Bay [SFB] RWQCB, 2013):

- The natural receiving water temperature of intrastate waters will not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.
- At no time or place will the temperature of cold- or warm-intrastate waters be increased by more than 5°F above natural receiving water temperature.

Water quality objectives for water temperature within the Extended, Secondary, and Primary study areas are also specified in the SWRCB Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (SWRCB, 1998).

7.2.1.2 *Salinity*

Salinity is a measure of dissolved mineral salts in the water. Salinity can be measured as total dissolved solids (TDS)[1] or electrical conductivity (EC).[2] In high concentrations, the mineral salts can cause adverse impacts to municipal and industrial water users, agriculture, and fish and wildlife. The impacts of salinity on municipal water supplies include aesthetic, taste, odor, or color effects, and corrosion to water system facilities. Some salts such as bromide can increase the formation of harmful byproducts in drinking water.

High salinity in irrigation water inhibits water and nutrient intake by plants, resulting in yield reduction. Saline conditions could be a result of high salinity source water used for direct irrigation, or saline soil water due to saline water accumulation and poor drainage. Plant toxicity can occur when the soil water salinity is greater than the internal salinity of the plant, resulting in the accumulation of salt ions in the leaves. The most common ions that cause toxicity are chloride, sodium, and boron. Boron accumulates in the soil and is particularly troublesome because it can cause toxicity at very low concentrations and accumulates in the soil.

Irrigation water containing high levels of sodium is of special concern because of its potential to create a sodium hazard in the soil. Sodium hazard, expressed as sodium adsorption ratio, occurs when sodium is adsorbed and becomes attached to soil particles, rendering the soil hard and compact when dry and increasingly impervious to water penetration. Fine-textured soils high in clay content are most vulnerable to sodium hazard.

Sulfate salts affect sensitive crops by limiting the uptake of calcium and increasing the adsorption of sodium and potassium, upsetting the cationic balance within the plant. High concentrations of potassium may introduce magnesium and iron deficiency.

Different crops have different tolerance levels for salinity, with forage crops being the most resistant and fruit crops being the most sensitive. Crops are also most sensitive to salinity during seed germination, and more tolerant during later growth stages.

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[1] TDS is a measure of the mass of the salt per unit volume, generally expressed as milligram per liter (mg/L).

[2] EC is a measure of water's ability to conduct an electric current based on its dissolved salt content, expressed as micromhos per centimeter (µmhos/cm).

Some fish and wildlife species are also affected by salinity concentrations in the Sacramento-San Joaquin River Delta (Delta) because certain levels of salinity are required during different life stages for the species to survive. One measure of salinity in the western Delta is “X2.” X2 refers to the horizontal distance from the Golden Gate Bridge up the axis of the Delta estuary to where a tidally averaged near-bottom salinity concentration of 2 parts of salt in 1,000 parts of water occurs. The X2 standard was established to improve shallow water estuarine habitat in the months of February through June and relates to the extent of salinity movement into the Delta (California Department of Water Resources [DWR] et al., 2013). The location of X2 is important to both aquatic life and water supply beneficial uses.

The SWRCB Decision-1641 includes “spring X2” criteria that require operations of the CVP and SWP to include upstream reservoir releases from February through June to maintain fresh water and estuarine conditions in the western Delta to protect aquatic life. In addition, the 2008 U.S. Fish and Wildlife Service (USFWS) biological opinion on the Long-term Coordinated Operation of the CVP and SWP (USFWS, 2008a) also includes an additional Delta salinity requirement in September and October in wet and above normal water years (Fall X2), as described in Chapter 6 Surface Water Resources.

One of the salinity concerns for drinking water is related to bromide, a naturally occurring constituent. The primary source of bromide in the Delta is salt water intrusion from the Pacific Ocean. During treatment of drinking water, ozone, which is used as a disinfectant and for controlling taste and odor issues, reacts with bromide to form bromate. Bromate is a disinfection byproduct (DBP) that is regulated by the USEPA and the State of California because of its cancer-causing potential.

7.2.1.3 *Mercury*

Mercury is a constituent of concern throughout California, both as total mercury and as biologically formed methylmercury. Methylmercury is more readily absorbed by aquatic organisms than elemental mercury. Mercury persists and accumulates in the food chain.

Mercury present in the Delta, its tributaries, Suisun Marsh, and San Francisco Bay occurs because of historical and ongoing deposition from upstream tributaries and discharge of methylated mercury from wetlands adjacent to these water bodies. Most of the mercury present in these locations is the result of historical mining of mercury ore in the Coast Ranges (via Putah and Cache creeks to the Yolo Bypass) and the extensive use of elemental mercury to aid gold extraction processes in the Sierra Nevada (via Sacramento, San Joaquin, Cosumnes, and Mokelumne rivers) (Alpers et al., 2008; Wiener et al., 2003). Elemental mercury from historical gold mining processes appears to be more bioavailable than that from mercury ore tailings because mercury used in gold mining processes was purified before use (CVRWQCB, 2010). Additional sources of mercury include natural geologic sources and atmospheric deposition from both local and distant sources (SWRCB, 2014).

Methylation of mercury is an important step in the entrance of mercury into the food chain (USEPA, 2001a). Methylation can occur in sediment and the water column. Methylmercury is absorbed more quickly by aquatic organisms than inorganic mercury, and it biomagnifies (i.e., increases the concentration of methylmercury in predatory fish from eating smaller contaminated fish and invertebrates). The pH of water, the length of the aquatic food chain, water temperature, and dissolved organic material and sulfate are all factors that can contribute to the bioaccumulation of methylmercury in aquatic organisms. The extent of wetlands subject to inundation and drying cycles, soil types, and erosion can also contribute to the amount of mercury that is transported from soils to water bodies. These effects can be seen in the variability in bioaccumulated mercury in the Delta.

Consumption of contaminated fish is the major pathway for human exposure to methylmercury (USEPA, 2001a). Once consumed, methylmercury is almost completely absorbed into the blood and transported to all tissues, and is also transmitted to the fetus through the placenta. Neurotoxicity from methylmercury can result in mental retardation, cerebral palsy, deafness, blindness, and dysarthria in utero, and in sensory and motor impairments in adults. Cardiovascular and immunological effects from low-dose methylmercury exposure have also been reported.

7.2.1.4 *Selenium*

Selenium is a constituent of concern because of its potential effects on water quality and on aquatic and terrestrial resources, primarily in the San Joaquin Valley and the San Francisco Bay, and in some locations in Southern California (SWRCB, 2011a). Elevated concentrations of selenium in soil and waterways within the San Joaquin Valley, and to some extent in the San Francisco Bay, are primarily the result of erosion of uplifted selenium-enriched Cretaceous and Tertiary marine sedimentary rock located at the base of the east-facing side of the Coastal Range (Presser and Piper, 1998; Presser, 1994). The selenium-enriched soil derived from the eroded rock has been transported to the western San Joaquin Valley through natural processes. Selenium is mobilized from the soil by irrigation practices and transported to waterways receiving agricultural drainage (Presser and Ohlendorf, 1987).

Other sources of selenium to the western Delta and San Francisco Bay include several oil refineries located in the vicinity of Carquinez Strait and San Pablo Bay (Presser and Luoma, 2013; SWRCB, 2011a). The specific water bodies within these areas that may be affected by the project and are impaired by selenium, as specified on the California CWA Section 303(d) list, include the Panoche Creek (from Silver Creek to Belmont Avenue), Mendota Pool, and Grasslands Marshes, which drain toward the San Joaquin River—more specifically toward the following locations (SWRCB, 2011a):

- San Joaquin River from Mud Slough to Merced River
- Delta downstream of the San Joaquin River
- Suisun Bay downstream of the San Joaquin River and the oil refineries

Adverse effects of selenium may occur as a result of either a selenium deficiency or excess in the diet (Agency for Toxic Substances and Disease Registry, 2003; Ohlendorf, 2003); the latter is the primary concern in the case of the impaired water bodies on the Section 303(d) list. Because of the known effects of selenium bioaccumulation from water to aquatic organisms and to higher trophic levels in the food chain, the fresh water, estuarine and wildlife habitat (spawning, reproduction, and/or early development); and rare, threatened, or endangered species are the most sensitive receptors to selenium exposure, as related to beneficial uses of water bodies. Thus, excessive receptor exposure can lead to selenium toxicity or selenosis and result in death or deformities of fish embryos, fry, or larvae (Ohlendorf, 2003; Janz et al., 2010). Consequently, regulatory agencies have established exposure criteria to protect the beneficial uses of the water bodies.

7.2.1.5 *Other Heavy Metals*

In addition to mercury and selenium, other heavy metals, including cadmium, copper, and zinc, impair beneficial uses of water bodies. Cadmium, copper, and zinc enter the water bodies with the sediment from eroded soils and discharges from abandoned mines, and in stormwater runoff from municipal areas (SWRCB, 2011a). The primary source in the Central Valley appears to be tailing piles located at abandoned mine sites. Many of these mines are located upstream of reservoirs; therefore, the sediment that includes the heavy metal constituents is generally captured upstream of the dam. Heavy metals appear to cause health concerns in aquatic resources and in humans that consume the fish from these water bodies.

7.2.1.6 *Nutrients*

Nutrients such as nitrogen and phosphorus come from natural sources such as weathering of rocks, soil and atmospheric deposition, and from some stormwater runoff and wastewater discharges (National Oceanic and Atmospheric Administration [NOAA], 2014; USEPA, 1998).

Although nutrients are necessary for a healthy ecosystem, over-enrichment of nitrogen and phosphorus can contribute to a process known as eutrophication, where growth of aquatic plant life is stimulated and toxicity can occur when there is an excessive growth of macrophytes, phytoplankton, or potentially toxic algal blooms. Eutrophication may lead to a decrease of dissolved oxygen, typically at night when plants stop producing oxygen through photosynthesis but continue to use oxygen. Low dissolved oxygen levels can kill fish, cause an imbalance of prey and predator species, and result in a decline in aquatic resources (USEPA, 1998). Severely low dissolved oxygen conditions are referred to as anoxic and may enhance methylmercury production (SFB RWQCB, 2012). Over-enrichment can also contribute to cloudy or murky water by increasing the amount of materials (i.e., algae) suspended in the water. High levels of nutrients, low turbidity, and high water temperatures could also increase *Microsystis* blooms.

7.2.1.7 *Pathogens*

Point and non-point source discharges into Delta waters have the potential to introduce and elevate the levels of pathogens and other contaminants. *Cryptosporidium* and *Giardia* are two main pathogens of concern that are the focus of drinking water regulatory requirements promulgated by USEPA.

7.2.1.8 *Dissolved Oxygen*

Dissolved oxygen is a constituent of concern primarily in the lower Klamath River, Delta, and Suisun Marsh Wetlands (SWRCB, 2011a). Oxygen in water comes primarily from the atmosphere through diffusion at the water surface and photosynthesis by aquatic plants, which release oxygen in exchange for carbon dioxide (U.S. Geological Survey [USGS], 2014; NOAA, 2008a). Levels of dissolved oxygen vary with several factors, including season, time of day, water temperature, salinity, and organic matter. The season and time of day dictate photosynthesis processes, which require sunlight. Increases in water temperature and salinity reduce the solubility of oxygen (NOAA, 2008b). Fungus and bacteria use oxygen when decomposing organic matter in water bodies. So, the more organic matter present in a water body, the more potential for dissolved oxygen levels to decline.

Low dissolved oxygen is a water quality concern for aquatic organisms because it impairs growth, immunity, and reproduction, and causes asphyxiation and death (NCRWQCB, 2011).

To protect aquatic life, the USEPA has established water quality standards for dissolved oxygen (USEPA, 1986). However, to protect the beneficial uses of California's water bodies, including warm and cold fresh water habitats in both tidal and non-tidal waters, site-specific water quality objectives were established.

7.2.1.9 *Organic Carbon*

Chlorine, commonly used as a disinfectant in drinking water treatment processes, reacts with organic carbon to form DBPs such as trihalomethanes and haloacetic acids. Delta waters contain high levels of dissolved organic compounds and bromide, increasing the formation of DBP. Use of chloramines for disinfection would reduce the production of DBP, but chloramination can lead to the formation of carcinogenic N-nitrosamines, including N-nitrosodimethylamine. These interactions complicate the design of drinking water treatment processes and create the need to balance and trade off disinfection effectiveness with DBP creation. Balance and tradeoffs are also necessary between source water quality protection and ecosystem restoration actions that could increase the levels of organic carbon.

7.2.2 Extended Study Area

7.2.2.1 *San Luis Reservoir*

As described in Chapter 6 Surface Water Resources, San Luis Reservoir provides offstream storage for CVP and SWP water supplies prior to distribution of the water to areas in the San Joaquin Valley, San Francisco Bay Area, Central Coast, and Southern California. Water quality in the reservoir is heavily influenced by Delta water quality (as described under the Secondary Study Area), including salinity which is influenced by salinity in the waters diverted at Clifton Court Forebay and Jones Pumping Plant intake channel (see Section 7.2.3.8).

Water temperatures at San Luis Reservoir is influenced by local air temperatures and water storage elevations. High air temperatures combined with low water levels during the late summer and early fall months foster algae growth that can be as much as 35 feet thick on the water surface. The algal mats historically have been located at elevations above the outlets to the CVP Delta-Mendota Canal and the SWP/CVP San Luis Canal/California Aqueduct. However, the algae historically have been captured in the Upper Pacheco Intake that serves the Santa Clara Valley Water District and San Benito County Water District. The algae frequently make the water unsuitable for municipal water treatment or agricultural drip irrigation systems. Therefore, as water levels continue to decline into the algal mats, water supply to these CVP water users ceases.

7.2.3 Secondary Study Area

As described in Chapter 6 Surface Water Resources, the surface water resources in the Secondary Study Area that could be affected by Project operations include Trinity River and Lower Klamath River downstream of the Trinity River confluence, Clear Lake and Whiskeytown Lake, Shasta Lake and Upper Sacramento River, Lower Feather River from Lake Oroville to Sacramento River, Lower American River from Lake Natoma to Sacramento River, Yolo Bypass, the Delta, and Suisun Bay and Suisun Marsh.

7.2.3.1 *Trinity River and Lower Klamath River*

The Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake and Lewiston Reservoir to the confluence with the Klamath River, and in Humboldt and Del Norte counties along the Klamath River from the confluence with the Trinity River to the Pacific Ocean.

Several water quality requirements affect the Klamath River and Trinity River basins. Beneficial uses and water quality objectives provided by the NCRWQCB and the Hoopa Valley Tribal Environmental Protection Agency (TEPA) are intended to protect the beneficial uses (see Table 7-1). The Yurok Tribe Basin Plan for the Yurok Indian Reservation and the Resighini Rancheria Tribal Water Quality Ordinance also regulate portions of the Trinity and Klamath rivers that flow into and through the reservations.

The constituents of concern that are not in compliance with existing water quality standards and for which TMDLs are adopted or are in development are presented in Appendix 7A California State Water Resources Control Board Constituents of Concern of Water Bodies in the Study Area. The primary water quality constituents of concern in the Trinity River downstream of Lewiston Reservoir and in the lower Klamath River that could be affected by the Project include water temperature, mercury, nutrients, and dissolved oxygen.

Water Temperature

A majority of the reaches of the Trinity and Klamath rivers are not listed on the Section 303(d) list as impaired by water temperature (Appendix 7A California State Water Resources Control Board Constituents of Concern of Water Bodies in the Study Area). However, the hydrologic area of the South Fork Trinity River and the lower hydrologic area of the Klamath River are listed for elevated water temperatures adversely affecting the cold fresh water habitat (SWRCB, 2011c-h).

Water temperatures in the Trinity and lower Klamath rivers must be maintained to protect and support resident and seasonal fish species habitats. The North Coast Basin Plan designates narrative and numeric water temperature objectives applicable to surface waters in the Trinity River and the lower Klamath River basins. Other objectives and criteria specific to each region are specified below.

Temperature objectives for the Trinity River are set forth in SWRCB Water Rights Order 90-5, as summarized in Table 7-2. These objectives vary by reach and by season. Between Lewiston Dam and Douglas City Bridge, the daily average temperature should not exceed 60 degrees Fahrenheit (°F) from July 1 to September 14, and 56°F from September 15 to September 30. From October 1 to December 31, the daily average temperature should not exceed 56°F between Lewiston Dam and the confluence of the North Fork Trinity River. Reclamation consults with USFWS in establishing a schedule of releases from Lewiston Dam that can best achieve these objectives. These temperature objectives were included in the NCRWQCB Basin Plan to improve conditions for salmon and steelhead trout populations (NCRWQCB, 2011).

Table 7-2
Water Quality Objectives for Temperature in the Trinity River

Period	Daily Average Temperature Not to Exceed	Trinity River Reach
July 1 – September 14	60° F	Lewiston Dam to Douglas City Bridge
September 15 – October 1	56° F	Lewiston Dam to Douglas City Bridge
October 1 – December 31	56° F	Lewiston Dam to confluence of North Fork Trinity River

Source: NCRWQCB, 2011

Natural causes of temperature exceedances, such as unusually excessive ambient air temperatures coupled with flows, intended to protect aquatic habitat specified in the Trinity River Flow Evaluation (TRFE) report are not considered to violate the water quality objectives stated in the Hoopa Valley Indian Reservation Basin Plan. Temperature objectives for the Trinity River as it passes through the Hoopa Valley Reservation vary seasonally and are precipitation dependent (Table 7-3). The water quality objectives are based on temperature-flow relationships that maintain TRFE flow regimes and protect adult salmonids holding and spawning. The objectives are also consistent with the temperature standards specified in the NCRWQCB Basin Plan (Hoopa Valley TEPA, 2008).

Table 7-3
Trinity River Temperature Criteria for the Hoopa Valley Indian Reservation

Dates	Running 7-day Average Temperature not to Exceed[a]	
	Extremely Wet, Wet and Normal Water Years	Dry and Critically Dry Water Years
May 23 – June 4	59ºF	62.6ºF
June 5 – July 9	62.6ºF	68ºF
July 10 – September 14	72.0ºF	74.0ºF[b]
September 15 – October 31	66.0ºF	66.0ºF
November 1 – May 22	55.4ºF	59.0ºF

[a]Temperature standards will be monitored at the Weitchpec temperature monitoring station operated and maintained by Reclamation. Temperature standard violations will be determined if more than 10 percent of 7-day running averages exceed the standard, to be determined by the number of days exceeded for that seasonal period (i.e., for June 16 to September 14, a 91-day period, 10 percent exceedance will equate to 9 days).

[b]For the seasonal period of June 16 to September 14, temperatures on the main stem Trinity River at the Weitchpec gauging station were used to determine running 7-day averages.

Source: Adapted from Hoopa Valley TEPA, 2008

Mercury

Trinity Lake and the upper hydrologic area of the East Fork Trinity River are two water bodies in the North Coast that were placed on the Section 303(d) list because of mercury contamination (SWRCB, 2011a). Mercury in Trinity Lake can be attributed to atmospheric deposition, natural sources, resource extractions, and other unknown sources (SWRCB, 2011b). Significant mercury contamination is likely the result of historical gold and mercury mining activities along the East Fork Trinity River at the inactive Altoona Mercury Mine (May et al., 2004).

The commercial or recreational collection of fish, shellfish, or organisms was deemed a concern because fish tissue exceeded USEPA's recommended Fish Tissue Residue Criteria for human health of 0.3 milligram of methylmercury (wet weight) per kilogram (kg) of fish tissue (SWRCB, 2011b-g). This criterion is based on the consumption-weighted rate of 0.0175 kg of total fish and shellfish per day.

In an effort to meet the water quality standards in Trinity Lake and the East Fork of Trinity River, a TMDL is expected to be completed by 2019.

Nutrients

Nutrients are a constituent of concern in the lower Klamath River (SWRCB, 2011a, 2011h). The lower Klamath River was placed on the Section 303(d) list approved by USEPA in 2010 for being impaired by nutrients (SWRCB, 2011a). Nutrient levels in the Klamath Estuary can promote levels of algal growth that cause a nuisance or adversely affect beneficial uses (U.S. Department of the Interior and California Department of Fish and Game, 2012). The Klamath River receives the greatest nutrient loading from the Upper Klamath basin, approximately 40 percent of its total contaminant load (NCRWQCB, 2010).

The Klamath River nutrient TMDLs are in the process of being implemented by the NCRWQCB and other affiliated agencies, including the SWRCB, USEPA, Reclamation, USFWS, the Oregon Department of Environmental Quality (responsible for implementation of the Klamath TMDLs in Oregon), and other state, federal, and private agencies with operations that affect the Klamath River (NCRWQCB, 2010).

Dissolved Oxygen

The lower Klamath River was placed on the Section 303(d) list because of low dissolved oxygen (SWRCB, 2011a). To protect the beneficial uses of the lower Klamath River, including the cold fresh water habitat, dissolved oxygen objectives were established in the NCRWQCB Basin Plan (2010) and the Hoopa Valley TEPA (2008) for the Klamath River and its major tributary, the Trinity River. The NCRWQCB basin plan also includes a dissolved oxygen TMDL, which addresses control measures for nutrients, organic matter, total phosphorous, and total nitrogen. The basin plan includes numerical targets for benthic algae biomass, suspended algae chlorophyll-a, *microcystis aeruginosa*, and microcystin toxin.

7.2.3.2 *Clear Creek and Whiskeytown Lake*

As described in Chapter 6 Surface Water Resources, water is released from Lewiston Reservoir into Whiskeytown Lake. Water from Whiskeytown Lake is released to the Sacramento River through the Spring Creek Tunnel, which conveys water to the Spring Creek Conduit, and then to Keswick Reservoir. The primary water quality constituents in Clear Creek and Whiskeytown Lake that could be affected by the Project include water temperature and mercury.

Water Temperature

Flows into Keswick Reservoir provide cold-water flows that reduce temperatures in the upper Sacramento River, especially during the fall months.

Water from Whiskeytown Lake also is released into Clear Creek directly from Whiskeytown Lake to provide for instream flows and water for users located within, or adjacent to, the Clear Creek watershed. The 2009 National Marine Fisheries Service (NMFS) biological opinion included an objective to reduce thermal stress to over-summering steelhead and spring-run Chinook salmon during holding, spawning, and embryo incubation. Reclamation manages Whiskeytown Lake releases to meet a daily water temperature criterion at the Igo gauge in Clear Creek of 60°F from June 1 through September 15, and 56°F from September 15 to October 31.

Temperature curtains in Lewiston Reservoir and Whiskeytown Lake provide for temperature management into the Sacramento River and Clear Creek.

Mercury

Mercury in the Sacramento River Basin can be attributed to gold mining activity within the Clear Creek and the Sacramento River watersheds. USEPA approved a decision to place Whiskeytown Lake and Clear Creek on the Section 303(d) list for mercury contamination (SWRCB, 2011a). In an effort to protect the beneficial uses of these water bodies, including the protection of aquatic and human health, USEPA has recommended Fish Tissue Residue Criteria for human health of 0.3 mg of methylmercury (wet weight) per kg of fish tissue. Mercury generally is associated with sediments in Clear Creek upstream of Whiskeytown Lake, and sediments contained within Whiskeytown Lake.

7.2.3.3 *Shasta Lake and Upper Sacramento River from Shasta Lake to Verona*

Water quality in the upper Sacramento River is influenced by releases from Shasta Lake and diversions from Trinity Lake. Annual and seasonal flows in the Sacramento River watershed are highly variable from year to year, as described in Chapter 6 Surface Water Resources. These variations in flow are a source of variability in water quality in the Sacramento drainage.

The primary water quality constituents of concern in Shasta Lake and the upper Sacramento River that could be affected by the Project include water temperature, salinity, mercury, and heavy metals.

Water Temperature

Water temperature on the Sacramento River system is influenced by several factors, including the relative water temperatures and ratios of releases from Shasta Dam and from the Spring Creek Power Plant. The temperature of water released from Shasta Dam and the Spring Creek Power Plant is a function of the reservoir temperature profiles at the discharge points at Shasta and Whiskeytown, the depths from which releases are made, the seasonal management of the deep cold-water reserves, ambient seasonal air temperatures and other climatic conditions, tributary accretions and water temperatures, and residence time in Keswick, Whiskeytown, and Lewiston Reservoirs, and in the Sacramento River. Water temperature in the upper Sacramento River is governed by water rights permit requirements.

In 1990 and 1991, SWRCB issued Water Rights Orders 90-05 and 91-01, modifying Reclamation's water rights for the Sacramento River. The orders stated that Reclamation shall operate Keswick and Shasta dams and the Spring Creek Power Plant to meet a daily average water temperature of 56°F as far downstream in the Sacramento River as practicable during periods when higher temperatures would be harmful to fisheries. The optimal control point is near the Red Bluff Pumping Plant at the intake of the Tehama-Colusa Canal intake.

The water right orders also recommended the construction of a Shasta Temperature Control Device (TCD) to improve the management of the limited cold-water resources. Construction of the TCD at Shasta Dam was completed in 1997. This device is designed for greater flexibility in managing the cold-water reserves in Shasta Lake while enabling hydroelectric power generation to occur and to improve salmon habitat conditions in the upper Sacramento River. The TCD is also designed to enable selective release of water from varying lake levels through the power plant in order to manage and maintain adequate water temperatures in the Sacramento River downstream of Keswick Dam.

The 2009 NMFS biological opinion (NMFS, 2009) also included requirements related to minimum storage in Shasta Lake to achieve temperature compliance on the Sacramento River at the Clear Creek confluence, Ball's Ferry, Jelly's Ferry, and Bend Bridge. From April 15 through May 15, water temperatures are to be maintained at 56°F between Ball's Ferry and Bend Bridge.

Water bodies in the Upper Sacramento River watershed support the beneficial uses of both warm and cold fresh water habitat, which require that the water bodies maintain water temperatures suitable for multiple fish species (CVRWQCB, 2016). Water quality objectives have been established by the SWRCB for Sacramento River, as summarized in Table 7-4.

Table 7-4
Water Quality Objectives for Temperature in the Sacramento River

Applicable Water Bodies	Objective
Sacramento River from Keswick Dam to Hamilton City	> 56° F
Sacramento River from Hamilton City to the I Street Bridge (during periods when temperature increases will be detrimental to the fishery)	> 68° F

Source: CVRWQCB, 2016

The Sacramento River was not listed on the Section 303(d) list as impaired by water temperature (SWRCB, 2011a).

Mercury

Mercury in the Sacramento River Basin can be attributed to gold mining activity within the tributaries to the Sacramento River. The USEPA approved a decision to place Shasta Lake and the Sacramento River from Cottonwood Creek to Red Bluff on the Section 303(d) list because of mercury contamination (SWRCB, 2011a). Mercury is not a constituent of concern for the Sacramento River between Shasta Dam and Cottonwood Creek because the mercury is associated with sediments captured in Shasta Lake. Mercury that enters the Sacramento River downstream of Cottonwood Creek comes from the tributary streams to the Sacramento River, especially those without major dams. In an effort to protect the beneficial uses of these water bodies, including the protection of aquatic and human health, the USEPA has recommended Fish Tissue Residue Criteria for human health of 0.3 mg of methylmercury (wet weight) per kg of fish tissue.

Other Heavy Metals

Shasta Lake where West Squaw Creek enters the lake, Spring Creek (from Iron Mountain Mine to Keswick Reservoir), and Keswick Reservoir downstream of Spring Creek, were placed on the Section 303(d) list because of impairment by cadmium, copper, and zinc (SWRCB, 2011a). The Upper Sacramento River from Keswick Reservoir to Cottonwood Creek was previously listed on the Section 303(d) because of impairment by cadmium, copper, and zinc but was delisted after a TMDL was completed in 2002, and the SWRCB determined the water quality standard was met. The elevated levels were primarily the result of acid mine drainage discharged from inactive mines in the upper Sacramento River watershed, located upstream of Shasta and Keswick dams (CVRWQCB, 2002).

Cadmium, copper, and zinc contamination in the Sacramento River were addressed by the 2002 Upper Sacramento River TMDL and by water quality objectives in the Basin Plan (CVRWQCB, 2002). The TMDL for cadmium, copper, and zinc in Shasta Lake, Spring Creek, and Keswick Reservoir is expected to be completed in 2020 (SWRCB, 2011i, 2011j, 2011k). Heavy metals generally are associated with sediments that are contained within Shasta Lake and Keswick Reservoir; however, these sediments do not enter the Sacramento River, except during extremely high flow events. Heavy metals also enter the Sacramento River from tributaries located downstream of Keswick Reservoir.

7.2.3.4 *Sacramento River from Verona to the Delta (Freeport)*

The water quality of the lower Sacramento River is influenced by upstream sources, including the tributaries upstream of Verona (near the confluence of the Feather River with the Sacramento River), and Feather and American rivers.

In this reach of the Sacramento River, water temperatures are slightly influenced by the temperature of water released from Lake Oroville and Folsom Lake. Ambient air temperature is even more influential in this reach of the Sacramento River. However, water temperature objectives have not been established for this reach of the Sacramento River.

The primary water quality constituent of concern in the lower Sacramento River that could be affected by the Project is mercury.

Mercury

The Sacramento River from Verona to Freeport was placed on the Section 303(d) list because of mercury contamination (SWRCB, 2011a). Mercury in this reach of the river can be attributed to waterborne inputs from the tributaries on the upper Sacramento River downstream of Shasta Lake, the Feather River, the Yuba River, and the American River where historical mining occurred (SWRCB, 2011n). Tailings discharged from gold mines in the Sierra Nevada mountains during the 19th century contained significant amounts of mercury-laden sediment from the use of mercury to extract gold. These discharges caused the formation of anthropogenic alluvial fans at the base of the Sierra Nevada, most notably the Yuba Fan on the Yuba River, which is a major source of mercury into the Sacramento River.

The Sacramento River is a key source of mercury contamination into the Delta. More than 80 percent of total mercury flux to the Delta can be attributed to the Sacramento River Basin (CVRWQCB, 2010). The CVRWQCB (2010) compiled data from 2000 to 2003 and reported an average of 0.10 nanogram per liter (ng/L) in the Sacramento River at Freeport. Similarly, CALFED reported that the Sacramento River at Freeport contributed an average of 0.11 ng/L of methylmercury to the Delta from 2003 to 2006 (Foe et al., 2008).

Streambed sediment mercury concentrations from the Sacramento River and Delta regions were reported as part of the National Water Quality Assessment Program for the Sacramento River Basin (MacCoy and Domagalski, 1999). Within the Sacramento River, the higher concentrations of mercury were measured downstream of the Feather River (MacDonald et al., 2000).

In an effort to protect the beneficial uses of the Sacramento River, including the commercial and recreational collection of fish, shellfish, or organisms, the CVRWQCB (2016) made recommendations for the future reduction of mercury contamination. Additionally, the Delta Mercury Control Program (SWRCB, 2012) provides potential load allocations for mercury pertaining to the Sacramento River and the Yolo Bypass, while the Cache Creek Watershed Mercury Program provides load allocations for Cache Creek, Bear Creek, Sulphur Creek, and Harley Gulch.

7.2.3.5 *Lower Feather River from Lake Oroville to Sacramento River*

Lake Oroville provides cold-water releases to the Feather River to support beneficial uses, including municipal and agricultural water supply, contact and non-contact water recreation, and fish habitat and migration uses, for cold and warm water. The primary water quality constituents of concern in the lower Feather River that could be affected by the Project include water temperature and mercury.

Water Temperature

The Lower Feather River downstream of Lake Oroville is not listed on the Section 303(d) list as impaired by water temperature (SWRCB, 2011a). However, water temperature in the lower Feather River is crucial to maintaining fresh water habitat for both warm and cold fresh water fish species (DWR, 2007a). In addition to effects on fish species, agriculture is potentially affected by changes in water temperature because the temperatures of irrigation water can affect crop growth. In the Feather River Basin, the water temperatures need to be cool for the fish species and warm enough to support agricultural production, especially for rice production. Water-contact recreation can also be affected by water temperatures when water temperatures may be too cold for some water-contact recreation.

DWR operates Lake Oroville and the Thermalito Complex to meet temperature objectives established through a 1983 agreement with California Department of Fish and Game (now known as the California

Department of Fish and Wildlife [CDFW]) (as cited in NMFS, 2009). Water is released at different depths through shutters at the intake structures in Lake Oroville (DWR, 2007b). The water temperatures downstream of the Thermalito Complex are influenced by ambient air temperatures. Water temperatures vary seasonally and spatially between the low flow channel (LFC) and high flow channel (HFC) of the Lower Feather River downstream of the Thermalito Complex. Water temperatures in the LFC are managed to protect cold-water fish species.

Water temperatures in the LFC start to increase in March, with maximum temperatures occurring in July and early August (DWR, 2007b). Cooling of the LFC begins in September, with a minimum temperature occurring in February. At the Feather River Fish Hatchery, water temperatures are generally compliant with the 1983 Agreement. Water temperatures at Robinson Riffle are almost always met when the fish hatchery temperatures are met. Agricultural temperature requests for warmer water cannot always be satisfied because of the requirements of the fish species and the fluctuating meteorological conditions.

Temperatures in the HFC are influenced by releases from the Thermalito Afterbay and flow contributions from Honcut Creek, the Yuba River, and the Bear River from April through October (DWR, 2007b). Water temperatures in the HFC start to increase in March, with maximum temperatures occurring in July and August. In late August, the HFC water temperature begins to cool, reaching minimum temperatures by January or February. Honcut Creek and Bear River inflows tend to increase downstream temperatures as well, while flows from the Yuba River tend to cool downstream temperatures during the warmer months.

Mercury

The Lower Feather River is included on the Section 303(d) list for mercury contamination (SWRCB, 2011a). The Feather River has relatively large mercury loadings and high mercury concentrations in suspended sediment, as described above for the lower Sacramento River. Recent studies completed for Lake Oroville Federal Energy Regulatory Commission relicensing studies indicated that mercury consistently exceeded USEPA guidelines in most fish species and locations (DWR, 2007b). A beneficial effect of Lake Oroville is the capture of contaminated sediments, preventing their further transport downstream.

The Sacramento – San Joaquin Delta Estuary TMDL for methylmercury recommends that the Feather River be targeted for mercury reduction (CVRWQCB, 2010).

7.2.3.6 *Lower American River from Lake Natoma to the Sacramento River*

Water quality in this reach of the river is influenced by releases from Folsom Lake and Lake Natoma. The primary water quality constituents of concern in the lower American River that could be affected by the Project include water temperature and mercury.

Water Temperature

The lower American River downstream of Folsom Lake and Lake Natoma is not listed on the Section 303(d) list as impaired by water temperature (SWRCB, 2011a). However, this reach supports warm and cold fresh water habitat beneficial uses, as well as migration and spawning uses. In particular, in-stream rearing of juvenile steelhead requires certain water temperatures that are targeted through water temperature objectives (CVRWQCB, 2016; NMFS, 2009).

The CVP operates Folsom Lake to meet temperature objectives from October through May generally to provide suitable habitat for salmon and steelhead spawning, incubation, and rearing, while considering impacts to other CVP and SWP users. Instream flow objectives for June to September are set to provide suitable flows and water temperatures for juvenile steelhead rearing, while balancing the effects on temperature operations into October and November to help support fall-run Chinook salmon spawning.

In July 2006, Reclamation, the Sacramento Area Water Forum, and other stakeholders agreed to a flow and temperature regime (known as the Lower American River Flow Management Standard) to improve conditions for fish in the lower American River. Minimum flow requirements during October, November, and December are primarily intended to facilitate fall-run Chinook salmon spawning, and flow requirements during January and February facilitate fall-run Chinook salmon egg incubation and steelhead spawning. From March through May, minimum flow requirements are primarily intended to facilitate steelhead spawning and egg incubation, as well as juvenile rearing and downstream movement of fall-run Chinook salmon and steelhead. The June through September flows are designed to facilitate over-summer rearing by juvenile steelhead, although this period partially overlaps with adult fall-run Chinook salmon immigration.

Water temperature control operations in the lower American River are affected by many factors and operational tradeoffs. These include available cold-water resources, Nimbus release schedules, annual hydrology, Folsom power penstock shutter management flexibility, Folsom Dam Urban Water Supply TCD management, and Nimbus Hatchery considerations. Meeting both the summer steelhead and fall salmon temperature objectives without negatively affecting other CVP project purposes requires reserving water in Folsom Lake for use in the fall to provide suitable fall-run Chinook Salmon spawning temperatures. In most years, the volume of cold water is not sufficient to support strict compliance with the summer water temperature target of 65ºF at the downstream end of the compliance reach at the Watt Avenue Bridge, while at the same time reserving adequate water for fall releases to protect fall-run Chinook salmon, or in some cases, continuing to meet steelhead over-summer rearing objectives later in the summer. The Folsom Water Supply Intake TCD has provided additional flexibility to conserve cold water for later use.

Mercury

The American River from Lake Natoma to the confluence with the Sacramento River was placed on the Section 303(d) list because of mercury contamination in exceedance of California Office of Environmental Health Hazard Assessment's (OEHHA's) guidance tissue levels for mercury (SWRCB, 2011l). The major source of mercury to the lower American River is from tributaries downstream of Lake Natoma where historical mining activities occurred. Like the Feather River, the lower American River is recommended for initial mercury reduction efforts as part of the Delta TMDL for methylmercury.

7.2.3.7 *Yolo Bypass*

The Yolo Bypass supports a variety of beneficial uses, including agricultural supply, recreational uses, fish spawning and migration, and aquatic habitat use. The Yolo Bypass is used for agriculture production in times of low flow, and discharges to the Delta contribute to drinking water supplies. The Yolo Bypass also supports seasonal fish and wildlife. Water quality in the Yolo Bypass affects the agriculture, fish, and wildlife in the Yolo Bypass and beneficial uses in the Sacramento River downstream of Rio Vista, the western Delta, and Suisun Bay (CVRWQCB, 2016; Sommer et al., 2001). The primary water quality constituent of concern that could be affected by the Project is mercury.

Mercury

The Yolo Bypass contributes a significant amount of methylmercury and total mercury to the Delta (CVRWQCB, 2010). During high-flow events, water from the Sacramento River that enters the Yolo Bypass through Fremont Weir and the Sacramento Weir inundates the bypass. The Colusa Basin Drain and four westside tributaries also contribute to flows in the bypass. Inundation results in the transport of mercury into the bypass. Inundation is followed by periods during which the water drains toward the Sacramento River. The subsequent periods result in the drying of soils. Much of the mercury remains in the soils in the bypass. As the soil dries, the mercury oxidizes and forms methylated mercury compounds (methylmercury) (USGS, 2002).

Cache Creek, which is one of the four westside tributaries, is a major source of naturally occurring mercury to the Yolo Bypass. The suspended sediment from Cache Creek mine wastes is likely to deposit in the Yolo Bypass, which results in additional sources of methylmercury (CVRWQCB, 2010).

The Cache Creek Settling Basin (CCSB) captures sediment and mercury transported by Cache Creek; however, any sediment that is not captured is transported to the Yolo Bypass (approximately half of the sediment transported by Cache Creek). The California Toxics Rule mercury criterion of 0.050 microgram per liter for drinking water is exceeded in outflow from the CCSB (CVRWQCB, 2010).

The TMDL for methylmercury in the Delta recommends reducing mercury loads entering the CCSB, and regularly excavating the sediment accumulating in the CCSB, in order to increase its effectiveness and prevent its filling and thus cessation of sediment and mercury deposition. Additional reductions in mercury loading to Cache Creek will be achieved through the existing mercury TMDL in the watershed, which includes measures for mine remediation, erosion control in mercury-enriched areas, and the removal of floodplain sediments containing mercury (CVRWQCB, 2010). In addition to efforts targeting mercury loading reductions in Cache Creek, the TMDL includes methylmercury and total mercury load and waste load allocations for agricultural drainage, tributary inputs, and wastewater facilities in the Yolo Bypass to enable reductions in mercury.

7.2.3.8 *Delta*

The Delta is a source of drinking water supply to more than 25 million people located in the Delta; portions of the San Francisco Bay Area, San Joaquin Valley, and Central Coast; and Southern California. The Delta also is a source of agricultural water supply to users in the Delta and San Joaquin Valley, and portions of the San Francisco Bay Area, Central Coast, and Southern California. The Delta surface waters also provide habitat to extensive numbers of fish and wildlife species. Therefore, Delta water quality supports a wide range of beneficial uses.

The Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) designated drinking water as a municipal and domestic supply beneficial use for most waters in the Central Valley, including the Delta (CVRWQCB, 2011, 2016). It includes narrative objectives for chemical constituents, taste and odor, sediment, suspended material, and toxicity, and numeric objectives for chemical constituents and salinity. The Basin Plan incorporates by reference the primary and secondary maximum contaminant levels specified in Title 22 of the California Code of Regulations for waters designated for municipal uses.

Through the triennial review process, stakeholders prioritized the need for a drinking water policy and identified a number of drinking water constituents of concern, including salt (including bromide), nutrients, organic carbon, and pathogens such as *Cryptosporidium* and *Giardia*. In 2013, the CVRWQCB adopted Resolution No. R5-2013-0098, an amendment to the Basin Plan to establish a drinking water policy for surface waters of the Delta and its upstream tributaries. The amendment was approved by the SWRCB in the same year and approved by the Office of Administrative Law and USEPA in 2014. This amendment modified the water quality objectives of the Basin Plan to add a narrative water quality objective for *Cryptosporidium* and *Giardia*, and clarified that the existing narrative objective for chemical constituents includes drinking water chemical constituents of concern such as organic carbon. The amendment also established a Drinking Water Policy to maintain high quality of water, anti-degradation, application of water quality objectives, implementation of toxics standards for inland surface waters, enclosed bays, and estuaries, and continued coordinated monitoring, assessment, and reporting of identified drinking water constituents of concern.

The primary water quality constituents of concern in the Delta that could be affected by the Project are salinity, mercury, selenium, nutrients, and dissolved oxygen.

Salinity

Delta waterways were placed on the Section 303(d) list because of high EC (SWRCB, 2011a). The concentrations of salts and other materials in the Delta are affected by river inflows, tidal flows, agricultural diversions, drainage flows, wastewater discharges, water exports, cooling water intakes and discharges, and groundwater accretions, as shown in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes and Appendix 7D Sacramento-San Joaquin Delta Modeling.

The CVP and SWP are permitted by SWRCB in accordance with water rights to store water, divert water, and re-divert CVP and SWP water that has been stored in upstream reservoirs. The CVP's and SWP's water rights are superceded by the SWRCB's rights to protect the beneficial uses of water within the watersheds. As conditions of the water right permits and licenses, SWRCB requires the CVP and SWP to meet specific water quality objectives within the Delta.

The SWRCB adopted the 1995 Bay/Delta Water Quality Control Plan on May 22, 1995, which was implemented, in part, through the SWRCB Decision 1641 (adopted on December 29, 1999 and revised on March 15, 2000) (SWRCB, 2000). The SWRCB Decision 1641 amends certain terms and conditions of the CVP and SWP water rights to impose flow and water quality objectives to ensure protection of beneficial uses in the Delta and Suisun Marsh. The requirements in SWRCB Decision 1641 address the standards for fish and wildlife protection, municipal and industrial water quality, agricultural water quality, and Suisun Marsh salinity. These objectives include specific outflow requirements throughout the year, specific export limits in the spring, and export limits based on a percentage of estuary inflow throughout the year. The water quality objectives are designed to protect agricultural, municipal and industrial, and fishery uses, and vary throughout the year and by the wetness of the year. SWRCB Decision 1641 also authorizes the CVP and SWP to jointly use each other's points of diversion in the southern Delta, with conditional limitations and required response coordination plans.

SWRCB Decision 1641 contains numerous provisions that affect CVP and SWP operations to maintain water quality in the Delta. One of those criteria limits the amount of water exported from the Delta by the CVP and SWP from February through June based upon inflows from the Sacramento and San Joaquin rivers and the Export to Inflow ratio, to reduce potential impacts on migrating salmon and spawning delta smelt, Sacramento splittail, and striped bass. The SWRCB Decision 1641 includes Delta outflow criteria, including the spring X2 criteria described in Section 7.2.1.2.

The 2008 USFWS biological opinion also includes an additional Delta salinity requirement from September through November in wet and above normal water years (USFWS, 2008a). This requirement is frequently referred to as "Fall X2." The action requires that in September and October, salinity of 2 Practical Salinity Units to be maintained at 74 kilometers (km) upstream of the Golden Gate Bridge during wet years, and 81 km upstream of the Golden Gate Bridge during above normal water years when the preceding year was classified as a wet or above normal water year (as described in SWRCB Decision 1641). In November of these years, there is no specific X2 requirement; however, there is a requirement that all inflow into CVP and SWP upstream reservoirs be conveyed downstream to augment Delta outflow to maintain X2 at the locations in September and October. If storage increases during November under this action, the increased storage volume is to be released in December in addition to the requirements under SWRCB D-1641 net Delta Outflow Index.

Salinity in the Delta is also affected by operations of the CVP Delta Cross Channel Gates, a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. When the gates are open, water flows from the Sacramento River through the cross channel to channels of the lower Mokelumne and San Joaquin rivers toward the interior Delta to improve water quality and circulation patterns. Improved water quality contributes to low salinity in the central and south Delta and reduces salt water intrusion rates in the western Delta. During the late fall, winter, and spring, the gates are periodically closed to prevent migrating salmonids from entering the interior Delta in accordance with the SWRCB Decision 1641. The gates are also closed during high flows in the Sacramento River to reduce flood potential in the interior Delta.

Salinity in the south Delta had been affected by the SWRCB Decision 1422 that required Reclamation to operate New Melones Reservoir to maintain average monthly levels of 500 parts per million TDS in the San Joaquin River as it enters the Delta at Vernalis. SWRCB Decision 1641 modified the water quality objectives at Vernalis to include the irrigation and non-irrigation season EC objectives contained in the 1995 Water Quality Control Plan. Salinity in the south Delta is also affected by the 2009 NMFS biological opinion that established the San Joaquin River Inflow:Export (I:E) ratio. The I:E requires south Delta exports to be reduced during April and May to protect emigrating steelhead from the lower San Joaquin River into the south Delta channels and intakes. The I:E ratio from April 1 through May 31 specifies that Reclamation operates the New Melones Reservoir to maintain a flow schedule for the Stanislaus River at Goodwin based upon water year types. Implementation of the I:E ratio under all conditions would allow a minimum pumping rate of 1,500 cubic feet per second (cfs) to meet public health and safety needs of communities that solely rely upon water diverted from the CVP and SWP pumping plants.

The SWRCB Decision 1641 authorizes the CVP and SWP to jointly use each other's points of diversion (Jones and Banks pumping plants) in the south Delta, with conditional limitations and coordination plans.

The CVP and SWP are operated in a coordinated manner in accordance with the 1986 Coordinated Operation Agreement (COA) (United States Department of the Interior and California Resources Agency, 1986). The COA is an agreement between the Federal government and the State of California for the coordinated operation of the CVP and SWP. The COA specifies that the ratio of water to be provided by the CVP and SWP meets in-basin uses upstream of the Jones and Banks pumping plants, including water operations to meet salinity criteria. The 1986 COA framework neither contemplated nor addressed the application of criteria included in the SWRCB Decision 1641 or the biological opinions. CVP and SWP operators must continually work on a case-by-case basis with the regulatory agencies to meet the Projects' water right requirements, as described in Chapter 6 Surface Water Resources.

Salinity objectives for the southern Delta are now under review by the SWRCB as part of the periodic review of the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary.

Mercury

The Delta was placed on the Section 303(d) list because of mercury contamination (SWRCB, 2011a). In 2010, the RWQCB approved amendments to the Basin Plan for the Sacramento River and San Joaquin River basins to include the Sacramento-San Joaquin Delta methylmercury TMDL (CVRWQCB, 2016). The TMDL was created to control methylmercury and total mercury in the Delta, which is applicable to the Delta, Yolo Bypass, and their waterways.

Methylation processes in the Delta are enhanced by environmental characteristics such as the source of inorganic mercury, nutrient enrichment, dissolved oxygen in the water column, sediment organic content and grain size, water residence time and sediment accumulation, periodic drying and wetting, and fish species and age structure (Alpers et al., 2008). The mercury-laden sediment that accumulates in the Delta as a result of waterborne loading is subject to methylation (Heim et al., 2007). Waterborne methylmercury in the Delta may be a more significant factor to bioaccumulation in fish than mercury-laden sediment that is subject to methylation (Melwani et al., 2009). Another factor affecting bioaccumulation in fish may be dissolved organic carbon. Laboratory studies have shown mercury uptake is much higher in water with lower dissolved organic carbon (as might be expected from the tributaries versus the interior Delta) (Pickhardt et al., 2006).

Mercury exposure and methylation can affect the beneficial uses of the Delta, and receiving waters downstream such as the Suisun Bay, Carquinez Strait, San Pablo Bay, and San Francisco Bay. In an effort to meet the water quality objectives, the CVRWQCB plans to continue monitoring metals in the Delta and control mass emissions from inactive or abandoned mines and other significant sources (CVRWQCB, 2016). The CVRWQCB established the Mercury Exposure Reduction Program (MERP) to evaluate mercury reduction programs and to develop a better understanding of pathways for mercury bioaccumulation in Delta fish (SWRCB, 2012). The MERP is designed to build on previous CALFED efforts. The MERP was included as part of an amendment to the Sacramento River and San Joaquin River Basins Basin Plan in 2016 (CVRWQCB, 2016), and is applicable to people eating one meal of trophic-level three or four fish per week (32 gallons/day) from the Delta and Yolo Bypass, and their waterways. The two-phase program was put into effect October 20, 2011, and will be completed in 2030.

Selenium

Portions of the Delta were placed on the Section 303(d) list because of selenium contamination (SWRCB, 2011a). A TMDL for selenium in the North San Francisco Bay (defined to include a portion of the Delta, Suisun Bay, Carquinez Strait, San Pablo Bay, and the Central Bay) is being completed and a Preliminary Project Report was released in 2011 (SFB RWQCB, 2011). A range of concentrations for selenium in fish tissue from 6.0 to 8.1 micrograms per gram (µg/g) dry weight was proposed as a numeric target. This range is based on the minimal effects of selenium in whole-body fresh water fish and the 10 percent effect level concentration.

In efforts to address the selenium in the Delta and water bodies downstream, the SFB RWQCB conducted a new TMDL project to address selenium toxicity in the North Bay (SFB RWQCB, 2011, 2013). The North Bay selenium TMDL identified and characterized selenium sources to the North Bay and the processes that control the uptake of selenium by fish and wildlife. The TMDL was published in August

2016 and quantified selenium loads, develop and assign waste load and load allocations among sources, and include an implementation plan designed to achieve the TMDL and protect beneficial uses.

The U.S. Environmental Protection Agency published proposed rules for numeric criteria for selenium for the San Francisco Bay and Delta in July 2016. Comments were accepted on the proposed rules through October 2016. It is anticipated that revised rules would be published in 2017.

Nutrients

The Delta is not included on the Section 303(d) list because of nutrients (SWRCB, 2011a). Nutrients, primarily nitrogen compounds and phosphorus, may trigger excessive growth of algae or toxic blue-green cyanobacteria. Primary sources of nutrients are erosion, agricultural runoff, urban runoff, and treated wastewater effluent. However, the Sacramento Regional Wastewater Treatment Plant, one of the largest historical point sources of ammonia in the Delta, is currently constructing expanded wastewater treatment processes to reduce the discharge of ammonia by 2020.

Dissolved Oxygen

The Stockton Deep Water Ship Channel in the Delta waterways was placed on the Section 303(d) list because of low dissolved oxygen (SWRCB, 2011a).

Low dissolved oxygen is of concern in the interior Delta because of enhanced treated effluent loading from Stockton, agricultural runoff, and reduced flushing of dead-end channels. Middle River, Old River, and the Stockton Deep Water Ship Channel are listed as impaired because of dissolved oxygen depletion, with dissolved oxygen concentration criteria set at 6 milligrams per liter (mg/L) minimum for the San Joaquin River between Turner Cut and Stockton from September 1 to November 30 (SWRCB, 2011a, 2006b). Following recent upgrades to the Stockton Regional Wastewater Control Facility in 2006, fewer oxygen demand constituents have been discharged into the channels. A TMDL addressing impairment resulting from low dissolved oxygen was approved by USEPA in 2007 to meet the water quality standards in the Stockton Deep Water Ship Channel.

7.2.3.9 *Suisun Bay and Suisun Marsh*

Suisun Bay and Suisun Marsh are located in transition zones between upstream fresh water inputs and tidal saline flux from San Francisco Bay. Water quality in the Suisun Bay and Suisun Marsh have been recently altered because of the presence of invasive benthic grazing clams that have substantially altered the Suisun Bay food web and historical patterns (Kimmerer, 2004; Jassby et al., 2002). Although turbidity remains high and limiting to primary productivity in Suisun Bay, there has been a long-term trend toward increased water clarity. Suisun Bay has low retention time, brackish and fresh water conditions, low nutrients, and high particulate matter and light attenuation (Cloern et al., 2012). The primary water quality constituents of concern in Suisun Bay and Suisun Marsh that could be affected by the Project include salinity, mercury, selenium, nutrients, and dissolved oxygen. Total organic carbon is not a constituent of concern for Suisun Bay and Suisun Marsh.

Salinity

The Suisun Marsh Wetlands was placed on the Section 303(d) list approved by USEPA in 2010 for impairment by salinity. The wetlands are also impaired by TDS and chlorides (SWRCB, 2011a).

In an effort to protect the beneficial uses, including estuarine habitat, narrative and numeric objectives were specified by the SWRCB in Decision 1641.

A contractual agreement among DWR, Reclamation, CDFW, and Suisun Resource Conservation District contains provisions for DWR and Reclamation to mitigate the effects on Suisun Marsh channel water salinity from SWP and CVP operations and other upstream diversions. The Suisun Marsh Preservation Agreement (SMPA) requires DWR and Reclamation to meet salinity standards, sets a timeline for implementing the Plan of Protection, and specifies monitoring and mitigation requirements. SWRCB Decision 1485 established salinity standards in 1978 and SWRCB Decision 1641.

There are two primary physical mechanisms for meeting salinity standards set forth in SWRCB Decision 1641 and the SMPA: (1) the implementation and operation of physical facilities in Suisun Marsh; and (2) management of Delta outflow. The facilities include the Suisun Marsh Salinity Control Gates (SMSCG), Roaring River Distribution System, and Morrow Island Distribution System (MIDS). The SMSCG is located on Montezuma Slough about 2 miles downstream of the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. The gates are operated to decrease the salinity of the water in Montezuma Slough by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides, and retaining lower salinity Sacramento River water from the previous ebb tide. The SMSCG are operated from October to May. The Roaring River Distribution System was constructed by DWR to provide lower salinity water to 5,000 acres of private and 3,000 acres of CDFW-managed wetlands on Simmons, Hammond, Van Sickle, Wheeler, and Grizzly islands. The MIDS was constructed in the southwestern Suisun Marsh to convey drainage water from the adjacent managed wetlands into Suisun Slough and Grizzly Bay to increase circulation and reduce salinity in Goodyear Slough. The MIDS is operated year-round but most actively from September through June.

Mercury

Suisun Bay and Suisun Marsh were placed on the Section 303(d) list because of mercury concentrations (SWRCB, 2011a). The San Francisco Bay Mercury TMDL includes water quality objectives related to mercury in Suisun Bay (SFB RWQCB, 2013). For the Suisun Marsh, a TMDL was specified in the Sacramento-San Joaquin Delta methylmercury TMDL (CVRWQCB, 2010) and was completed in September 2012 (SFB RWQCB, 2012). Water quality objectives for Suisun Bay are specified in the San Francisco Bay Mercury TMDL (SFB RWQCB, 2013).

Selenium

Although the Suisun Marsh is not identified as an impaired water body for selenium contamination on the Section 303(d) list, selenium is identified as a cause for impairment for the adjacent water body, Suisun Bay (SWRCB, 2011a). The impairment of Suisun Bay by selenium can be attributed to exotic species and discharge from industrial point sources and natural sources (SWRCB, 2011p). *Corbula (Potamocorbula) amurensis*, a species of clam that is an important food source for sturgeon and certain ducks, is a bioaccumulator for selenium (Beckon and Maurer, 2008; USFWS, 2008b). This exotic species was first discovered in Suisun Bay in 1986 and became common by 1990, from San Pablo Bay through Suisun Bay (Cohen, 2011). Selenium also accumulates in Suisun Bay via flows from the San Joaquin River and historical industrial discharges.

A TMDL for Selenium in the North San Francisco Bay, defined to include a portion of the Delta, Suisun Bay, Carquinez Strait, San Pablo Bay, and the Central Bay, is being completed, and a Preliminary Project Report was released in 2011 (SFB RWQCB, 2011). A range of concentrations for selenium in fish tissue from 6.0 to 8.1 µg/g dry weight was proposed as a numeric target. This range is based on the minimal effects of selenium in whole body fresh water fish and the 10 percent effect level concentration.

As described above, the SFB RWQCB conducted a new TMDL project to address selenium toxicity in the North Bay (SFB RWQCB, 2011, 2013). The North Bay selenium TMDL identified and characterized selenium sources to the North Bay and the processes that control the uptake of selenium by fish and wildlife. The TMDL was published in August 2016 and quantified selenium loads, develop and assign waste load and load allocations among sources, and include an implementation plan designed to achieve the TMDL and protect beneficial uses.

Nutrients

Suisun Marsh is a water body in the San Francisco Bay. It was placed on the Section 303(d) list because of high concentrations of nutrients (SWRCB, 2011a). According to the Final California 2010 Integrated Report (Section 303(d) list/305(b) Report) Supporting Information, nutrients in Suisun Marsh can be attributed to flow regulation and modification, urban runoff, and storm sewers (SWRCB, 2011b, 2011c). More specific sources of nutrients to Suisun Marsh include agricultural, urban, and livestock grazing drainage through tributaries, the Sacramento River and San Joaquin River through the Delta, nutrient exchange with Suisun Bay, atmospheric deposition, and wastewater treatment plant discharges (Tetra Tech Inc. and Wetlands and Water Resources [WWR], 2013).

Concentrations of ammonia from 2000 to 2011 in the receiving waters from Boynton, Peytonia, Sheldrake, and Chadbourne sloughs (0 to 0.4 mg/L), and in Suisun Slough (0 to 0.3 mg/L), exceeded the maximum water quality objective concentration for ammonia (Tetra Tech Inc. and WWR, 2013). Elevated concentrations of chlorophyll-a, in comparison to concentrations at reference sites at Mallard Slough, suggest possible impairments by nutrients. Other possible impairments of the narrative criteria by nutrients were suggested, resulting in excess algal growth in wetlands, elevated organic carbon, and impacts on dissolved oxygen and mercury methylation.

Dissolved Oxygen

The Suisun Marsh Wetlands were placed on the Section 303(d) list because of dissolved oxygen impairment (SWRCB, 2011a). Suisun Marsh was also placed on the Section 303(d) list because of organic enrichment, which can enhance microbial production and activity, and decomposition of organic matter that can cause low dissolved oxygen levels.

Insufficient dissolved oxygen can alter the well-being of the estuarine habitat, fish spawning, warm fresh water habitat, and wildlife habitat (SFB RWQCB, 2013). Flow regulation and modification, urban runoff, and storm sewers affect the dissolved oxygen levels in the marsh (SWRCB, 2011q). Specific oxygen demanding sources that cause low dissolved oxygen levels are “grazed open areas, wastewater treatment plant discharges, wastes from boats, decomposition of vegetation in the tidal marshes, and agricultural and municipal drainages” (Tetra Tech, Inc. and WWR, 2013).

7.2.4 Primary Study Area

7.2.4.1 *Overview and Methodology*

The Project features are located in Glenn and Colusa counties west of the Sacramento River, and extend into the Coast Range foothills. Elevations within these counties range from approximately 35 feet along the Sacramento River to 3,000 feet in the foothills. This area is characterized by seasons of hot dry summers and moderately cold, moist winters. Summer temperatures commonly exceed 100°F. Approximately 95 percent of the annual precipitation occurs during the winter months. Precipitation ranges from approximately 18 inches per year on the valley floor, 21 inches per year at Stony Gorge

Reservoir, and 51 inches per year at the upper elevations of the Coast Range crest. Precipitation generally approaches the area from the west, is highest at the Coast Range crest, and diminishes as elevations drop toward the Sacramento Valley in a “rain-shadow” effect.

The proposed Sites Reservoir would impound Stone Corral and Funks creeks, as well as inundate Salt Lake. The chemical quality of waters in this area is directly related to the geology in the tributary drainage, as well as agricultural and cattle grazing land uses. Streams from the coastal sedimentary formation are substantially higher in dissolved solids and EC than the Sacramento River.

DWR began monthly sampling of streams in the Primary Study Area in 1997, including physical parameters, nutrients, minerals, and metals in the water column (DWR, 2012), as well as mercury analysis of sport fish tissues collected from nearby existing reservoirs, including East Park, Stony Gorge, and Black Butte (DWR, 2007a). Routine water quality monitoring by DWR was periodically suspended due to funding limitations during portions of 2008 and 2009, and ended following the January 2010 monitoring run. Sampling results were then compared to Central Valley Basin Plan water quality criteria (CVRWQCB, 2011) (Appendix 7A California State Water Resources Control Board Constituents of Concern of Water Bodies in the Study Area) and USEPA ambient water quality criteria to prevent nuisance algal growth in streams (USEPA, 2001b).

7.2.4.2 *East Park and Stony Gorge Reservoirs*

East Park and Stony Gorge reservoirs were sampled during the summer of 2000 to evaluate the extent of mercury contamination in fish because these reservoirs are representative of conditions that could be expected in the proposed Sites Reservoir. DWR analyses of total recoverable mercury indicate that levels in samples collected near the bottom of the water column at Stony Gorge and Black Butte reservoirs, exceeded the California Toxics Rule for protection of human health.

Fish tissue samples were collected by DWR from East Park and Stony Gorge reservoirs during 2000 to 2001. Neither catfish nor bass composites collected from East Park Reservoir exceeded the OEHHA screening value or USEPA criterion, although mercury levels in the small-sized bass approached these values, and a very large channel catfish that was analyzed individually contained tissue mercury at over twice the level of the screening value and criterion limits. Mercury concentrations in tissues of channel catfish collected from Stony Gorge Reservoir contained levels less than the screening value and criterion (DWR, 2007a).

7.2.4.3 *Salt Lake*

Saline water has been observed to seep from underground salt springs in the vicinity of the Salt Lake fault along the slopes above the valley and along the valley floor within the proposed inundation area of Sites Reservoir. These areas are generally located in the Funks Creek watershed. The water from the underground springs accumulates along the trough of the valley and forms Salt Lake (USGS, 1915). The size of Salt Lake and adjacent seasonal brackish wetlands varies with time. The wetted area appears to vary from 0 to 30 acres. The deeper water appears to be approximately 15 acres based on observations in 2017. The depth of the water has not been monitored.

Salt Lake was only sampled on a few occasions from 1997 to 1998. In August 1997, the Salt Lake was dry. In September 1997, the springs were bubbling and the EC was 194,100 micromhos per centimeter (µmhos/cm) as compared to 3,490 µmhos/cm for the nearby Stone Corral Creek. In January 1998, there was less than 1 cfs of flow from the springs, and the EC was 7,200 µmhos/cm as compared to

540 µmhos/cm for the nearby Stone Corral Creek. From these samples, it was found that waters from this location are extremely high in minerals. The EC value on one occasion reached 194,100 micromhos per centimeter. The TDS measurement at this time was 258,000 mg/L. EC, TDS, sodium, and boron exceeded all Central Valley Basin Plan criteria. A few metals also were noted at very high concentrations (aluminum, iron, and manganese) and exceeded all criteria, and a few others exceeded some criteria (arsenic, copper, lead, and nickel). Levels of ammonia and orthophosphate also were noted at high levels and exceeded criteria. Temperatures from this site were variable, and probably depend on seasonal conditions. Concentrations present in water from this site likely depend on the season and flow.

7.2.4.4 *Funks Creek*

Funks Creek originates at approximately 850 feet elevation in the foothills west of Antelope Valley. The banks of this intermittent stream are heavily eroded and the gravel bed is highly disturbed and compacted by cattle. Along the north end of Antelope Valley, Funks Creek receives underground drainage from Salt Lake. Funks Creek widens as it cuts through Logan Ridge and enters the western side of the Sacramento Valley, although flows are still intermittent. Approximately 1 mile downstream of Logan Ridge, Funks Creek is impounded by Funks Reservoir. This reservoir is fed mainly from waters of the Tehama-Colusa Canal. Downstream of the reservoir, Funks Creek is bordered by agricultural lands, and much of this reach is channelized before emptying into Stone Corral Creek. This portion of Funks Creek likely has some flow year round, due to leakage from the dam at Funks Reservoir.

DWR observed aluminum, arsenic, copper, iron, manganese, mercury, nickel, and phosphorus in Funks Creek at the Glenn-Colusa Irrigation District (GCID) Main Canal station during intermittent water quality sampling. The concentrations appeared to be higher during and immediately following storm events.

7.2.4.5 *Stone Corral Creek*

Stone Corral Creek originates at approximately 700 feet elevation in the foothills west of Antelope Valley. As the intermittent stream flows into the grasslands of Antelope Valley, the channel is narrow and the banks eroded. The much larger Antelope Creek flows into Stone Corral Creek from the south near the town of Sites. Stone Corral Creek flows through the gap in the foothills and into the western Sacramento Valley.

DWR observed aluminum, arsenic, copper, iron, manganese, nickel, and phosphorus during intermittent sampling in Stone Corral Creek near Sites station during intermittent water quality sampling. The concentrations appeared to be higher during and immediately following storm events.

7.2.4.6 *Tehama-Colusa Canal*

The intake for the Tehama-Colusa Canal occurs at the southeast end of the City of Red Bluff at River Mile (RM) 243. The intake occurs downstream of the mouth of Red Bank Creek. The Tehama-Colusa Canal is approximately 111 miles long and extends from Red Bluff in Tehama County to downstream of Dunnigan in Yolo County. Funks Reservoir is approximately 66 canal miles downstream of the intake at the Sacramento River.

DWR observed aluminum, arsenic, cadmium, and iron during intermittent sampling in the Tehama-Colusa Canal downstream of the siphon under Stony Creek during intermittent water quality sampling.

7.2.4.7 *Glenn-Colusa Irrigation District Main Canal*

The intake for the GCID Main Canal is on a side channel off the Sacramento River at RM 205.5, north of the town of Hamilton City. GCID's Hamilton City pump station, located at the intake, diverts water into the GCID Main Canal from the Sacramento River for distribution within the GCID service area. The canal is an unlined earthen channel that stretches approximately 65 miles from the system diversion point near Hamilton City to its downstream southern terminus at the CBD near Williams, in Colusa County.

DWR observed aluminum, arsenic, cadmium, copper, iron, mercury, manganese, and phosphorus during intermittent sampling in the GCID Main Canal intake during intermittent water quality sampling.

7.2.4.8 *Colusa Basin Drain*

The CBD is a human-made channel located in Glenn, Colusa, and Yolo counties, and was designed to convey agricultural return flows and storm runoff from the Colusa Basin to the Sacramento River at the Knights Landing Outfall Gates at Sacramento RM 34.15. The Colusa Basin Drain receives inflow from local creeks, including Funks and Stone Corral creeks, and discharge and runoff from the Colusa agricultural basin. Under conditions of low water levels, it drains by gravity into the Sacramento River at Knights Landing; however, when the water levels at Knights Landing are too high for this gravity flow to occur, discharge from the Colusa Basin Drain is routed directly to the Yolo Bypass through the Knights Landing Ridge Cut (USGS, 2002). Beneficial uses designated for the Colusa Basin Drain include agricultural irrigation and stock watering, water contact recreation, and warm- and cold-water habitat, and migration and spawning for aquatic biota (CVRWQCB, 2016). In spite of the many uses of the waterway, the Colusa Basin Drain is listed as impaired for numerous contaminants. Water quality constituents of concern include mercury, dissolved oxygen, pathogens, unknown toxicity, salinity, nutrients, organic carbon, and sulfates.

Mercury

The Colusa Basin Drain was placed on the Section 303(d) list because of mercury contamination that exceeded the USEPA fish tissue residue criterion for methylmercury in fish (SWRCB, 2011o). The Colusa Basin Drain contributed 3.3 percent of total mercury inputs to the Sacramento Basin between 1984 and 2003 (CVRWQCB, 2010). A TMDL for the Colusa Basin Drain is expected to be completed in 2021 (SWRCB, 2011o).

Dissolved Oxygen

The Colusa Basin Drain was placed on the Section 303(d) list because of low dissolved oxygen (SWRCB, 2011a). According to the Final California 2010 Integrated Report (Section 303(d)/305(b) Report) Supporting Information, the sources contributing to the dissolved oxygen impairment are unknown (SWRCB, 2011o).

Pesticides

The Colusa Basin Drain was placed on the Section 303(d) list because of organophosphate pesticide contamination, including by azinphos-methyl (Guthion), diazinon, dichlorodiphenyltrichloroethane, and malathion, and because of organochlorine pesticide contamination, including by dieldrin (SWRCB, 2011o).

Other Constituents of Concern

The Colusa Basin Drain is also listed as contaminated by *E. coli* and unknown toxicity (SWRCB, 2011o). The Knights Landing Ridge Cut and Colusa Basin Drain confluence are listed as contaminated by boron, low dissolved oxygen, and high salinity. A USGS study of Yolo Bypass water quality in 2000 also reported that significant concentrations of ammonium, dissolved organic carbon, and sulfate in the Yolo Bypass were correlated with high concentrations in the Colusa Basin Drain (SWRCB, 2011m; USGS, 2002).

7.2.4.9 *Sacramento River Opposite Moulton Weir*

DWR monitored water quality at the Sacramento River along the western bank opposite Moulton Weir station from 2000 to 2010. The water quality samples included aluminum, arsenic, copper, iron, mercury, manganese, lead, and phosphorus. Total aluminum levels in the Sacramento River at this location frequently exceeded aquatic life criteria during associated high flow conditions in the river, but rarely exceeded drinking water criteria and the agricultural goal. Arsenic levels exceeded human toxicity thresholds in all samples collected, and the criterion for protection of aquatic life for cadmium was occasionally exceeded. Copper levels frequently exceeded hardness-dependent aquatic life protection criteria during high flow conditions in the river, and iron levels frequently exceeded drinking water and aquatic life protection criteria, as well as the agricultural goal during the same river conditions. Dissolved iron levels exceeded the Central Valley Basin Plan level occasionally. Mercury levels approached, but did not exceed, the CTR criterion during the highest flows in the river. Manganese levels occasionally exceeded drinking water standards and the agricultural goal, and lead levels rarely exceeded drinking water criteria. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

7.3 Environmental Impacts/Environmental Consequences

7.3.1 Section 303 Evaluation Criteria and Significance Thresholds

Significance criteria represent the thresholds that were used to identify whether an impact would be potentially significant. Appendix G of the *CEQA Guidelines* suggests the following evaluation criteria for water quality:

Would the Project:

- Violate any water quality standards or waste discharge requirements?
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
- Otherwise substantially degrade water quality?

The evaluation criteria used for this impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and the context and intensity of the environmental effects, as required pursuant to NEPA. For the purposes of this analysis, an alternative would result in a potentially significant impact if it would cause the following:

- A violation of any water quality standard or waste discharge requirement, or otherwise substantially degrade water quality

If a water quality constituent declines under the action alternatives as compared to the Existing Conditions/No Project/No Action Condition, the changes are not considered to be adverse.

Descriptions in changes in water quality are presented to provide a basis for understanding changes that could occur to designated beneficial uses. However, the specific changes to beneficial uses are addressed in specific environmental resources chapters in this EIR/EIS associated with each beneficial use. For example, changes in water temperature or salinity could affect aquatic resources under the action alternatives as compared to the Existing Conditions/No Project/No Action Condition. Therefore, the changes in water temperature and salinity are presented in this chapter as part of the description of Surface Water Quality; and the changes in Aquatic Resources are presented in Chapter 12. Because the values under the action alternatives and the Existing Conditions/No Project/No Action Condition are only being reported in this chapter, no specific environmental impacts/environmental consequences are presented in this chapter. The environmental effects of these changes under CEQA and NEPA are presented for the following resources, as follows: biological resources (Chapter 12 Aquatic Biological Resources, Chapter 13 Botanical Resources, Chapter 14 Terrestrial Biological Resources), and agricultural production (Chapter 22 Socioeconomics and Chapter 23 Environmental Justice). Specific impact analyses and mitigation measures related to changes in these resources that are a result of changes in surface water quality conditions are provided in those chapters as appropriate.

7.3.1.1 *Use of Numerical Models*

The water quality results are either directly from the CALSIM II model or from models that rely upon the CALSIM II model. As described in Chapter 6 Surface Water Resources, the CALSIM II model simulates 82 years of CVP and SWP operations on a monthly time step. This monthly simulation of CVP and SWP operations that in reality occur at the daily or even hourly level results in several limitations in the use of the CALSIM II model results. To make the most appropriate use of the CALSIM II monthly results, they should be used in a comparative analysis of the alternatives. Given the CALSIM II model uses a monthly time step, incremental flow and storage changes of 5 percent or less are generally considered within the standard range of uncertainty associated with model processing, and as such, flow changes of 5 percent or less were considered to be similar to Existing Conditions/No Project/No Action flow levels in the comparative analyses using CALSIM II and DSM2 conducted in this EIR/EIS.

The incremental differences between 5 and 10 percent changes under the action alternatives and the Existing Conditions/No Project/No Action Condition are also affected by the limitations of using monthly models. Therefore, if the quantitative changes between an action alternative and the Existing Conditions/No Project/No Action Condition are between 5 and 10 percent in the CALSIM II or DSM2 model results, the changes in the conditions under the specific alternative would be considered to be "less than significant" as compared to conditions under the Existing Conditions/No Project/No Action Condition, unless the difference increases the occurrence of a violation of a water quality standard.

The CALSIM II model results are also used as inputs to the water temperature models, including the Upper Sacramento River Water Quality Model (USRWQM), Reclamation's Temperature Model, the Folsom Reservoir CE-QUAL-W2 Temperature Model, and the Sites Reservoir Discharge Temperature Model. The temperature models are capable of simulating temperatures on a sub-monthly time step. However, because the inputs from the CALSIM II model are monthly, the analysis of water temperatures is based on monthly average water temperature results. For this monthly analysis, it was determined that incremental changes of 0.5°F in mean monthly water temperatures would be within the model uncertainty. Therefore, changes of 0.5°F or less are considered to be not substantially different, or "similar" in this comparative analysis. Descriptions of changes in reservoir and stream temperatures are presented; however, no specific environmental consequences or environmental impact results are presented in this chapter because the environmental effects of these changes under CEQA and NEPA are more related to conditions of aquatic resources (Chapter 12 Aquatic Biological Resources). Specific impacts analyses and mitigation measures related to changes in aquatic resources as a result of temperature changes are provided in Chapter 12 Aquatic Biological Resources.

7.3.2 Impact Assessment Assumptions and Methodology

Combinations of Project facilities were used to create Alternatives A, B, C, C_1, and D. In resource chapters, the Authority and Reclamation describe the potential impacts associated with the construction, operation, and maintenance of each of the Project facilities for each of the five action alternatives. Some Project features/facilities and operations (e.g., reservoir size, overhead power line alignments, provision of water for local uses) differ by alternative and are evaluated in detail within each of the resource areas chapters. As such, the Authority has evaluated all potential impacts with each feature individually and collectively, and may choose to select or combine individual features as determined necessary.

Impacts associated with the construction, operation, and maintenance for Alternative C_1 would be the same as those for Alternative C and are therefore not discussed separately below.

7.3.2.1 *Assumptions*

The following assumptions were made regarding Project-related impacts (construction, operation, and maintenance impacts) to water quality:

- **Extended, Secondary, and Primary Study Areas**
  - Construction and operations activities related to the Project would require issuance of a Stormwater Pollution Prevention Permit (SWPPP) from the CVRWQCB to protect water quality, conditions of which would be part of the implementation of the project as an environmental commitment as described in Chapter 3 Description of the Sites Reservoir Alternatives.
  - Changes in CVP and SWP operations under the action alternatives as compared to the Existing Conditions/No Project/No Action Condition could result in changes to surface water quality from changes in reservoir storage and river flows, and could result in water quality changes. As described in Section 7.2, numerous constituents of concern have been identified in the surface waters of the Extended, Secondary, and Primary study areas. These constituents are not critical in all water bodies, and not all constituents would be affected by changes in CVP and SWP operations from implementation of the action alternatives. The groups of constituents that could be affected by implementation of the action alternatives have been identified through consideration of constituents of concern and the anticipated implementation of TMDLs by 2030. For the constituents that have approved TMDLs or are anticipated to have approved TMDLs in the 2020s, it is assumed that concentrations of these constituents would not be allowed to increase or cause further degradation under the TMDLs. It is also assumed that implementation of the TMDLs would be successful and constituent concentrations would be within regulatory criteria by 2030.

- **Extended Study Area**
  - There would be no construction in the Extended Study Area. Therefore, the impact analysis does not address construction impacts to water quality in the Extended Study Area.
- **Secondary Study Area**
  - Construction in the Secondary Study Area would be limited to installation of two additional pump into an existing concrete bay within the existing Red Bluff Pumping Plant, as described in Chapter 3 Description of the Sites Reservoir Alternatives. No construction activities would occur outside, where constituents could enter the water bodies. Therefore, the impact analysis does not address construction impacts to water quality in the Secondary Study Area.
- **Primary Study Area**
  - Direct Project-related construction activities would occur in the Primary Study Area. Construction activities along the Sacramento River would be conducted during months when instream flows are managed outside of the flood season (e.g., June 15th to September 15th).
  - As described in Chapter 3 Description of the Sites Reservoir Alternatives, the Recreation Areas, Road Relocations and South Bridge, Sites Electrical Switchyard, Field Office Maintenance Yard, Delevan Pipeline Electrical Switchyard, terminal regulating reservoir (TRR) Electrical Switchyard, TRR Pipeline Road, Sites/Delevan Overhead Power Line, roads, bridges, and the Project Buffer would be constructed on dry land and in accordance with the SWPPP criteria established by the CVRWQCB to avoid adverse impacts to nearby water bodies. Therefore, the impact analysis does not address construction impacts of these facilities to water quality in the Primary Study Area.
  - The existing bank protection located upstream of the proposed Delevan Pipeline Intake/Discharge Facilities would continue to be maintained and remain functional.
  - No additional channel stabilization, grade control measures, or dredging in the Sacramento River at or upstream of the Delevan Pipeline Intake and/or Discharge Facilities would be required.

7.3.2.2 *Methodology*

Existing conditions and the future No Project/No Action alternatives were assumed to be similar in the Primary Study Area given the generally rural nature of the area and limited potential for growth and development in Glenn and Colusa counties within the 2030 study period used for this Environmental Impact Report/Environmental Impact Statement (EIR/EIS) as further described in Chapter 2 Alternatives Analysis. As a result, within the Primary Study Area, it is anticipated that the No Project/No Action Alternative would not entail material changes in conditions as compared to the existing conditions baseline.

With respect to the Extended and Secondary study areas, the effects of the proposed action alternatives would be primarily related to changes to available water supplies in the Extended and Secondary study areas and the Project's cooperative operations with other existing large reservoirs in the Sacramento watershed, and the resultant potential impacts and benefits to biological resources, land use, recreation, socioeconomic conditions, and other resource areas. The Department of Water Resources has projected future water demands through 2030 conditions that assume the vast majority of CVP and SWP water contractors would use their total contract amounts, and that most senior water rights users would use most of their water rights. This increased demand in addition to the projects currently under construction and those that have received approvals and permits at the time of preparation of the EIR/EIS would constitute the No Project/No Action Condition. As described in Chapter 2 Alternative Analysis, the primary difference in these projected water demands would be in the Sacramento Valley, and as of the time of preparation of this EIR/EIS, the water demands have expanded to the levels projected to be achieved on or before 2030.

Accordingly, existing conditions and the No Project/No Action alternatives are assumed to be the same for this EIR/EIS and, as such, are referred to as the Existing Conditions/No Project/No Action Condition, which is further discussed in Chapter 2 Alternatives Analysis. With respect to applicable reasonably foreseeable plans, projects, programs, and policies that may be implemented in the future but that have not yet been approved, these are included as part of the analysis of cumulative impacts in Chapter 35 Cumulative Impacts.

This section describes the approach used to evaluate the surface water quality impacts of the alternatives. Surface water quality was evaluated quantitatively for water temperature and salinity, and qualitatively for mercury, as described below. Impacts associated with the construction, operation, and maintenance for Alternative C_1 would be the same as those for Alternative C and are therefore not discussed separately below.

Many of the quantitative results are presented by Water Year Type as defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 2006a) for the full 82-year simulation period (water years 1922 through 2003). The different Water Year Types and the percentage of the 82-year simulation period that each type of water year occurred are as follows:

- Wet: 32 percent
- Above Normal: 15 percent
- Below Normal: 17 percent
- Dry: 22 percent
- Critical: 15 percent

Water Temperature

Water temperatures were modeled for major rivers in the Secondary Study Area to evaluate the thermal impacts of Project operations using the USRWQM, Reclamation’s Temperature Model, the Folsom Reservoir CE-QUAL-W2 Temperature Model, and the Sites Reservoir Discharge Temperature Model. For the Trinity River and Upper Sacramento River locations, where results were available from the USRWQM and Reclamation’s Temperature Model, the results from the USRWQM model were used. For the American River, where results were available from Reclamation’s Temperature Model and the CE-QUAL-W2 Temperature Model, the results of the CE-QUAL-W2 model were used.

The Upper Sacramento River Daily Operations Model (USRDOM) description and results are included in Appendix 6C Upper Sacramento River Daily River Flow and Operations Modeling. Descriptions and results of the USRWQM, Reclamation’s Temperature Model, and the Folsom Reservoir CE-QUAL-W2 Temperature Model are included in Appendix 7E River Temperature Modeling. The results of the model for the American River are incorporated into Appendix 7E River Temperature Modeling following the results of the USRWQM and the Reclamation’s Temperature Model.

Upper Sacramento River Water Quality Model

USRWQM was developed using the HEC-5Q model to simulate mean daily (using 6-hour meteorology) reservoir and river temperatures at Shasta, Trinity, Lewiston, Whiskeytown, Keswick, and Black Butte reservoirs, and the Trinity River, Clear Creek, the upper Sacramento River from Shasta Lake to Knights Landing, and Stony Creek. USRWQM is designed for long-term planning simulations of temperature variability in these reservoirs and streams, given CVP and SWP project operations, and allows comparison between existing and assumed future scenarios. Daily flows, simulated in the USRDOM for an 82-year period (water years 1922 to 2003), are used as input to the USRWQM.

Reclamation's Temperature Model

The Reclamation Temperature Model is a reservoir and stream temperature model, which simulates monthly reservoir and stream temperatures used for evaluating the effects of CVP and SWP project operations on mean monthly water temperatures in the basin. The model simulates temperatures in five major reservoirs (Trinity Lake, Whiskeytown Reservoir, Shasta Lake, Lake Oroville, and Folsom Lake), four downstream regulating reservoirs (Lewiston Reservoir, Keswick Reservoir, Thermalito Complex, and Lake Natoma), and four main river systems (Trinity, Sacramento, lower Feather, and lower American rivers). The reservoir component of the Reclamation Temperature Model calculates temperature changes in main and regulating reservoirs. Using a regulating reservoir release temperature as the initial river temperature, the river model computes temperatures at several locations along the rivers. The calculation points for river temperatures generally coincide with tributary inflow locations.

The modeled temperatures used to represent waters in the Secondary Study Area include temperatures from three locations on both the Trinity River and Clear Creek, eight locations on the Sacramento River from Keswick to Freeport, and three locations in both the lower Feather and lower American rivers. Sacramento River locations modeled for the Primary Study Area include at Red Bluff, downstream of Red Bluff, downstream of Hamilton City, at Delevan, and downstream of Delevan.

Folsom Reservoir CE-QUAL-W2 Temperature Model

The Folsom Reservoir water temperature modeling tool (Placer County Water Agency [PCWA], 2015) was developed for PCWA's American River Water Rights Extension project to test the ability of alternative hydrology and reservoir operations scenarios to meet regulatory water temperature requirements (or targets if the requirement cannot be met) in the lower American River at Watt Avenue. The model simulates temperatures in Folsom Lake and temperatures in the American River downstream of Folsom to the confluence with the Sacramento River. The model has the capability of simulating the City of Folsom Temperature Control Device and the Folsom Dam Shutters. Given its recent and ongoing use in the evaluation of American River-specific actions and projects, the CE-QUAL-W2 Temperature Model represents the best available planning model for the American River.

Sites Reservoir Discharge Temperature Model

A preliminary Sites Reservoir Discharge Temperature Model was developed for the temperature analysis of the proposed Sites Reservoir. Alternatives C and D were evaluated using this model because these alternatives would result in the highest flows from Sites Reservoir to the Sacramento River during late summer months when temperatures are highest in the river. Under Alternatives A and B, flows into the Sacramento River in the late summer months, especially in the Dry and Critical Dry years, would be similar or less than flows under Alternatives C and D. Therefore, the results for Alternatives C and D were considered to be similar to conditions under Alternatives A and B.

The physical characteristics and the daily operations of Sites Reservoir, as proposed for Alternatives C and D, were derived from Alternatives C and D USRDOM simulations. Sites Reservoir inflow temperatures and the Sacramento River temperature targets were derived using the results from the Alternatives C and D USRWQM simulations. Inflow to Sites Reservoir was assumed to be the daily flow from the Holthouse Reservoir Complex to Sites Reservoir. Outflow from Sites Reservoir was specified using daily flow from Sites Reservoir to the Holthouse Reservoir Complex, as simulated in the USRDOM. Significant warming is not expected within the buried Delevan Pipeline between Sites Reservoir and the Sacramento River; therefore, changes in water temperatures within the Delevan Pipeline between the Sites Reservoir outlet and the Sacramento River was not included in the model. Sacramento River temperatures for the locations upstream from the proposed Delevan Pipeline Intake/Discharge Facilities were blended with simulated Sites Reservoir release temperatures. The blended temperature was then used to determine whether Sacramento River temperatures would be affected by Sites Reservoir releases.

Salinity

Salinity analyses are based upon changes in EC indicated in the modeling results from the CALSIM II model, DSM2 Delta Simulation Model (DSM2), and EC Mass Balance Approach.

CALSIM II Model

As described in Chapter 6 Surface Water Resources, CALSIM II is a reservoir-river basin planning model developed by DWR and Reclamation to simulate the operation of the CVP and SWP over a range of different hydrologic conditions. The use of CALSIM II allows for comparative changes or effects to the CVP and SWP water resources system associated with adding a new surface storage reservoir located north of the Delta.

The CALSIM II model provides results for the X2 position. Figure 7-1 shows the locations of selected SWRCB Decision 1641 water compliance stations located in the Delta that were used in this evaluation, including the three stations for defining the X2 standard. Figure 7-1 also includes lines showing the potential range of the X2 location, from 66 km to 95 km from the Golden Gate Bridge, in increments of 5 km. The model results for the X2 position are included in Appendix 6B Water Resources System Modeling.

DSM2 Model

DSM2 is a one-dimensional model used to simulate hydrodynamics and water quality in the Delta. DSM2 represents the best available planning model for Delta tidal hydrodynamics and salinity modeling. It is appropriate for describing the existing conditions in the Delta and performing simulations for the assessment of incremental environmental impacts caused by changes in the facilities and operations.

The DSM2 model has two separate components: HYDRO and QUAL. The HYDRO module is a one-dimensional, implicit, unsteady, open channel flow model that simulates flows, velocities, and water surface elevations. HYDRO provides the flow input for QUAL. The QUAL module is a one-dimensional model that simulates fate and transport of water quality constituents such as EC, given a flow field simulated by HYDRO. DSM2 QUAL provides EC estimates at various locations in the Delta, including at key salinity control points such as Emmaton, Jersey Point, and at the two export locations at the Banks

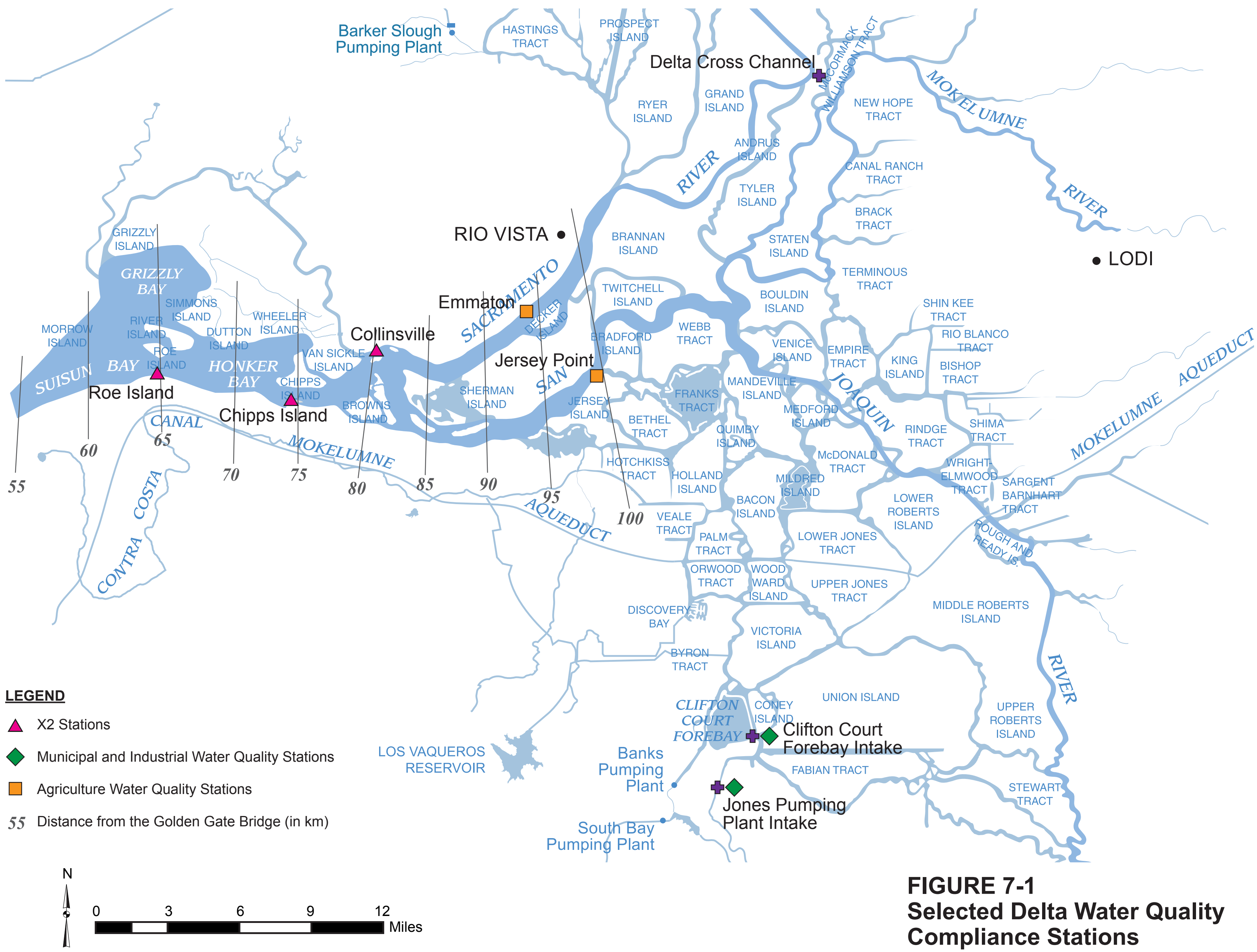

FIGURE 7-1
Selected Delta Water Quality Compliance Stations
Sites Reservoir Project EIR/EIS

Pumping Plant and the Jones Pumping Plant. The DSM2 model description and results are included in Appendix 7D Sacramento-San Joaquin Delta Modeling.

EC Mass Balance Approach

Worst-case EC conditions were simulated to assess the maximum potential impact of Project implementation on Sacramento River EC. The analysis included estimation of the worst-case concentrations for various sources along the Sacramento River, as well as the estimation of source water contribution and worst-case concentrations at locations of interest along the Sacramento River. The analysis calculated a simple mass balance using the source concentrations and the percent of source volumes estimated, based on the daily results from USRDOM modeling. The analysis was limited to the three proposed intake locations along the Sacramento River (Tehama-Colusa Canal Intake, GCID Main Canal Intake, and the proposed Delevan Pipeline Intake/Discharge Facilities). The Primary and Secondary study area analyses were formulated using the limited EC field measurements available for various tributaries (sources) and locations along the Sacramento River and assume worst-case EC conditions. The USRDOM description and results are included in Appendix 6C Upper Sacramento River Daily River Flow and Operations Modeling. The EC Mass Balance Approach description and results are included in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes.

Qualitative Analysis of Constituents

The qualitative analysis of changes in other constituents (e.g., mercury, selenium, nutrients) was based upon an analysis of potential changes in loadings from sources of the constituent and related changes in flows that would occur from implementation of the Project as compared to the Existing Conditions/ No Project/No Action Condition. For example, the qualitative analysis of changes in mercury is based upon changes in flow patterns from the major sources of mercury in the Sacramento River watershed (e.g., tributaries to the Sacramento River). In a similar manner, changes in methylmercury are based upon changes in physical conditions of wetland areas that would experience different inundation-drying patterns. For example, changes in flows through the Yolo Bypass were analyzed to assess the potential for additional introduction of mercury into the Yolo Bypass. Also analyzed was the potential for changes in inundation-drying patterns of the wetlands in the bypass that could result in methylmercury formation. These changes were modeled under the action alternatives to compare them to the Existing Conditions/ No Project/No Action Condition.

7.3.3 Topics Eliminated from Further Analytical Consideration

The major sources of selenium in the surface water bodies in the Extended, Secondary, and Primary study areas are from natural sources, related agricultural practices on the San Joaquin River, and from industries in the San Francisco Bay Area. As discussed in Chapter 6 Surface Water Resources, the action alternatives would not result in changes in San Joaquin River flow patterns at Vernalis as compared to the Existing Conditions/No Project/No Action Condition. The action alternatives also would not result in changes in generation of selenium from natural sources or San Francisco Bay Area industrial operations as compared to the Existing Conditions/No Project/No Action Condition. Therefore, the impact analyses related to selenium are not analyzed further in this EIR/EIS.

7.3.4 Section 303 Impacts Associated with Alternative A

7.3.4.1 *Extended Study Area*

Operation and Maintenance Impacts

San Luis Reservoir

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Surface Water Elevations

Reservoir surface water level fluctuations can exacerbate the nuisance of algae blooms when reservoir levels are low because of increased nutrient concentration, reduced reservoir mixing, and higher water temperatures during low storage conditions. With implementation of Alternative A, San Luis Reservoir would continue to experience water level fluctuations as in the past. The difference between the long-term average surface water elevations for Alternative A and conditions under the Existing Conditions/ No Project/No Action Condition would be less than 5 percent, as shown in Appendix 6B Water Resources System Modeling. Therefore, the potential for algal growth and associated water quality changes in San Luis Reservoir under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition.

Salinity

Salinity in San Luis Reservoir would be directly affected by salinity at the CVP Jones Pumping Plant and SWP Clifton Court Forebay (upstream of the SWP Banks Pumping Plant). Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar (within 5 percent) under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 6.1 percent higher under Alternative A, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir.

Summary

Implementation of Alternative A would result in similar potential for algal growth and associated water quality changes in San Luis Reservoir under Alternative A and the Existing Conditions/No Project/ No Action Condition. Implementation of Alternative A would result in a **less-than-significant impact** as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 6.1 percent higher under Alternative A. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir; therefore, changes in salinity under Alternative A would result in a **less-than-significant impact** as compared to conditions under the Existing Conditions/No Project/ No Action Condition.

7.3.4.2 *Secondary Study Area*

Operation and Maintenance Impacts

Trinity Lake, Trinity River Downstream of Trinity Lake and Lewiston Reservoir, and Klamath River Downstream of Trinity River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative A are either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Trinity River downstream of Lewiston Dam, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures on the Trinity River are similar under Alternative A and the Existing Conditions/ No Project/No Action Condition.

Because water temperatures in the lower Trinity River would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition, it is anticipated that implementation of Alternative A would not result in increased water temperatures on the lower Klamath River under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury in the Trinity River watershed are located upstream of Trinity Lake and accumulate within Trinity Lake. The generation rate and the accumulation rates of mercury in Trinity Lake would not be affected by implementation of Alternative A because there would be no construction of new facilities upstream of Trinity Lake. The operations of Trinity Lake, as reflected by end-of-month Trinity Lake storage, would be similar to conditions under the Existing Conditions/ No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Because there would be no additional mercury accumulation in the Trinity River watershed, no additional mercury loadings would occur in the lower Klamath River by implementation of Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients and Dissolved Oxygen

Because there would be no construction in the Trinity River watershed under Alternative A, and operations of Trinity Lake would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition, no changes in nutrients and dissolved oxygen would be anticipated under implementation of Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

As described in Section 7.2, sources of nutrients and other constituents of concern that reduce dissolved oxygen in the lower Klamath River are located upstream of the confluence with Trinity River. Flows in the Trinity River would be similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources. Therefore, occurrence or concentrations of these constituents of concern would not be affected by implementation of Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative A would result in **less-than-significant impacts** on water temperatures in the Trinity River and the lower Klamath River downstream of the confluence with the Trinity River as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative A would result in **no impact** on mercury, nutrients, and dissolved oxygen in the Trinity River and the lower Klamath River as compared to the Existing Conditions/No Project/No Action Condition.

Clear Creek Downstream of Whiskeytown Lake

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative A would be either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on Clear Creek at Igo, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures in Clear Creek downstream of Whiskeytown Lake would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury that are of concern in the Clear Creek watershed are located upstream of Whiskeytown Lake and accumulate within Whiskeytown Lake. The generation rate and the accumulation rates of mercury in Whiskeytown Lake would not be affected by implementation of Alternative A because there would be no construction of new facilities or changes in water supply facilities operations in the Clear Creek watershed as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative A would result in **less-than-significant impacts** on water temperatures in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative A would result in **no impact** on mercury concentrations in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Shasta Lake and Sacramento River from Shasta Lake and Keswick Reservoir to Freeport

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative A generally are either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition in the Sacramento River between the Keswick Reservoir and Freeport, as shown in Appendix 7E River Temperature Modeling. However, in April in Below Normal, Dry, and Critical water years, and along the Sacramento River at Ball's Ferry, Jelly's Ferry, and Bend Bridge; downstream of the Tehama-Colusa Canal and GCID Main Canal intakes; and downstream of the Delevan Pipeline Intake/Discharge

Facilities, temperatures under Alternative A would be 0.6 to 0.9°F higher as compared to the Existing Conditions/No Project/No Action Condition. The temperature values are less than 56°F (which is included in several water quality criteria as described in Section 7.2), except downstream of the GCID Main Canal intake near Hamilton City and the Delevan Pipeline Intake/Discharge Facilities.

Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative A as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury and Other Heavy Metals

As described in Section 7.2, the sources of mercury and other heavy metals in Shasta Lake are located upstream of the lake and accumulate within Shasta Lake. Mercury in the Sacramento River downstream of Keswick Reservoir is generated along the tributaries to the Sacramento River. The generation rate and the accumulation rates of mercury and other heavy metals in Shasta Lake or along the Sacramento River would not be affected by implementation of Alternative A because there would be no new facilities constructed upstream of Shasta Lake or along the tributaries. Operations of Shasta Lake under Alternative A, as reflected by end-of-month Shasta Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Salinity

As shown in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes, salinity along the Sacramento River downstream of the Tehama-Colusa Canal and GCID Main Canal intakes and the proposed Delevan Pipeline Discharge Facilities would be similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative A would result in similar water temperatures in the Sacramento River between Keswick Reservoir and Freeport, except in April during Below Normal, Dry, and Critical water years when the average monthly water temperatures would increase between 0.6 and 0.9°F as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative A as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury, other heavy metals, and salinity would be similar in the Sacramento River under Alternative A as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Section 303 Lake Oroville, Thermalito Complex, and Feather River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative A are reduced or less than 0.5ºF higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Feather River downstream of Lake Oroville, as shown in Appendix 7E River Temperature Modeling.

Mercury

As described in Section 7.2, the sources of mercury in Lake Oroville are located upstream of the lake and accumulate within Lake Oroville. The generation rate and the accumulation rates of mercury in Lake Oroville would not be affected by implementation of Alternative A because there would be no new facilities constructed upstream of Lake Oroville. Operations of Lake Oroville, as reflected by end-of-month Lake Oroville storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative A would result in reduced or similar water temperatures in the Feather River downstream of Lake Oroville as compared to the Existing Conditions/No Project/No Action Condition. Therefore, changes in water temperatures in the Feather River under Alternative A as compared to the Existing Conditions/No Project/No Action Condition would result in a **less-than-significant impact**.

Concentrations of mercury would be similar in the Feather River under Alternative A as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Folsom Lake, Lake Natoma, and American River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative A are generally reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition for the American River downstream of Lake Natoma, as shown in Appendix 7E River Temperature Modeling. However, in March and April in Critical water years, water temperatures along the lower American River are up to 0.7°F higher under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Also, in July in Critical water years, water temperatures along the lower American River are up to 0.6°F higher under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative A as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury

As described in Section 7.2, the sources of mercury in the American River are located in the tributaries upstream and downstream of Folsom Lake and Lake Natoma. The generation rate and the accumulation rates of mercury in Folsom Lake, Lake Natoma, or in the lower American River would not be affected by implementation of Alternative A because there would be no new facilities constructed upstream of Folsom Lake and Lake Natoma or along the tributaries. Operations of Folsom Lake under Alternative A, as reflected by end-of-month Folsom Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative A would result in similar water temperatures in the American River downstream of Folsom Lake and Lake Natoma, except in July in Below Normal water years when the average monthly water temperatures would increase by up to 1.2°F as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative A as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury would be similar in the lower American River under Alternative A as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Yolo Bypass

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Mercury

Water quality in the Yolo Bypass is related to water quality in the portion of the Sacramento River that flows directly into the bypass at the Fremont and Sacramento weirs, and water quality of flows from the Sutter Bypass that generally enter the Yolo Bypass at Fremont Weir. As described in Section 7.2, water quality concerns in the Yolo Bypass are primarily related to mercury that results in methylmercury production in the inundated areas. Therefore, reductions in inundated areas, especially in the wetter years, in the Yolo Bypass could result in similar methylmercury generation rates.

To analyze potential increases in inundated areas, the total flow discharged from the Yolo Bypass was modeled at the southern boundary of the bypass as the flows enter the Sacramento River near Rio Vista. During the summer and fall months, Yolo Bypass flows remain in the defined water bodies, including the Tule Canal and the Toe Drain. However, as water enters the bypass in the winter and spring months, the water flows into the agricultural and habitat areas, which are only periodically inundated.

As shown in Appendix 6B Water Resources System Modeling, flows in the winter and spring months (December through May) from the Yolo Bypass into the Sacramento River under Alternative A would be reduced or similar as compared to the Existing Conditions/No Project/No Action Condition. This would occur because water would be diverted into Sites Reservoir during this period. Therefore, the potential for inundation of land adjacent to the defined water bodies and the potential for increased generation of methylmercury would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Other sources of mercury in the Yolo Bypass, including Putah Creek, which is tributary to the bypass, would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Summary

Yolo Bypass flows would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition; therefore, the potential for increased occurrence of methylmercury oxidation in the Yolo Bypass under Alternative A would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Delta

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Inflow from the San Joaquin River into the Delta under Alternative A would be the same as that under the Existing Conditions/No Project/No Action Condition. However, inflows from the Sacramento River and export patterns at the CVP and SWP pumping plants would be different under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. The changes in flows would result in changes in salinity as indicated in Appendix 7D Sacramento-San Joaquin Delta Modeling.

Salinity at Emmaton and Jersey Point would be reduced or similar, except in January and February in Critical water years under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity would be reduced or similar during the compliance period of April 1 through August 15 required under the SWRCB Decision 1641 under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the SWP intake at the SWP North Bay Aqueduct and at the Contra Costa Water District (CCWD) intake along Victoria Canal would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the CVP Rock Slough intake, which provides water to CCWD, would be reduced or similar under Alternative A, except during November and December in Above Normal water years when salinity would increase up to 16.5 percent.

Salinity at the CCWD intake on Old River also would be reduced or similar under Alternative A, except during November in Above Normal water years when salinity would increase up to 9.7 percent. However, salinity during these months would be consistent with SWRCB Decision 1641 criteria.

Salinity at the CVP Jones Pumping Plant intake and SWP Clifton Court Forebay intake (upstream of the SWP Banks Pumping Plant) would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, except in November in Above Normal water years at Clifton Court Forebay when the salinity would be 6.1 percent higher under Alternative A, as shown in

Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for CVP and SWP intakes.

Mercury

As described in Section 7.2, the primary sources of mercury in the Delta are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in the Delta would be similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Within the Delta, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in the Delta under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Delta (effluent discharges and organic growths in the water) would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition. The dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar. Because these conditions would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition, the potential for *Microcystis* growth also would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Dissolved oxygen concentrations are also affected by reductions in Delta outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur in November or December at the CVP Rock Slough intake, at the CCWD intake on Old River, and at Clifton Court Forebay. EC during these months with salinity increases would not exceed SWRCB Decision 1641 criteria. Therefore, the overall changes in salinity in the Delta under Alternative A would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in the Delta under Alternative A would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Suisun Bay and Suisun Marsh

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Salinity

Alternative A would result in changes in inflow patterns into Suisun Bay, Suisun Marsh, and San Francisco Bay as compared to the Existing Conditions/No Project/No Action Condition. Salinity in Suisun Bay would be reduced or similar in the summer and fall months at Collinsville near the confluence of the Sacramento and San Joaquin rivers, Mallard Slough, and Port Chicago under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity at Collinsville under Alternative A would increase in December through February in Above Normal water years, January through March in Below Normal and Critical water years, and March and April in Dry water years as compared to the Existing Conditions/No Project/No Action Condition. Similar changes in salinity occur in the winter months at Mallard Slough and Port Chicago, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling.

The X2 position in the western Delta and Suisun Bay would be similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling.

Mercury

As described in Section 7.2, the primary sources of mercury in Suisun Bay and Suisun Marsh are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in Suisun Bay and Suisun Marsh would be similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Within Suisun Bay and Suisun Marsh, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in Suisun Bay and Suisun Marsh under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Suisun Bay and Suisun Marsh would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition. Also, the dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar.

Dissolved oxygen concentrations are also affected by reductions in Suisun Bay and Suisun Marsh outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity in the summer and fall months would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur from December through April when Delta outflow declines as water is diverted into Sites Reservoir. The salinity would continue to be consistent with SWRCB Decision 1641 criteria during those months. Therefore, overall changes in salinity in Suisun Bay and Suisun Marsh under Alternative A would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative A as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in Suisun Bay and Suisun Marsh under Alternative A would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

7.3.4.3 *Primary Study Area*

Construction, Operation, and Maintenance Impacts

Impacts to surface water quality are described separately for construction in areas with natural surface water bodies, man-made surface water bodies, and dry land, and for operations and maintenance of facilities located within water bodies and on dry land.

Construction within Natural Surface Water Bodies

Construction activities within natural surface water bodies would include construction of Golden Gate and Sites dams, which would require re-routing of stream flow during construction and disturb soils within the stream bed. Construction of the Delevan Pipeline Intake/Discharge Facilities within the Sacramento River would require construction of a cofferdam in the river. Following construction of the cofferdam, construction activities at the Delevan Pipeline Intake/Discharge Facilities location would occur outside of the Sacramento River until the completion of construction when the aboveground portion of the cofferdam structure would be removed.

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Construction along Funks and Stone Corral Creeks within Sites Reservoir Inundation Area

Construction of Golden Gate Dam would occur within Funks Creek, and construction of Sites Dam would occur within Stone Corral Creek. The construction would be completed in accordance with the SWPPP criteria issued by the CVRWQCB. The SWPPPs typically include requirements to divert stream flows around construction sites in temporary pipelines, which may require installation of cofferdams upstream of the construction sites. The water diverted from the streams and removed during dewatering activities could be required to flow through sediment basins or filters to remove the sediment before discharging the flows into Funks and Stone Corral creeks or other drainages near the construction sites. The SWPPPs typically also include erosion control measures to minimize sediment from entering the water bodies (e.g., rapid grow grass seeds, geotechnical fabric, silt fences).

Construction activities along Funks and Stone Corral creeks within the Sites Reservoir inundation area would include placement of piers to anchor the dam structures, grout injection of soil structure at the dam and at Salt Lake, placement of concrete at the dam structures, and blasting of hard rock. Measures in the

SWPPPs typically include requirements to capture loose dirt from the borings and blasting and chemical constituents from construction activities (e.g., grouting, concrete placement, painting) at elevations above the streams.

The SWPPPs typically include a monitoring and reporting program to the CVRWQCB that would address anticipated construction activities, including measures to contain construction materials in a manner to avoid discharge of these materials into the waterways. The monitoring programs also would include rapid response and cleanup activities to address spills and accidents.

Construction in the Sacramento River at the Delevan Pipeline Intake/Discharge Facilities Location

Construction within the Sacramento River at the Delevan Pipeline Intake/Discharge Facility would initially require construction of a cofferdam along the riverbank. Construction activities would include placement of piers along the cofferdam wall, placement of the sheet piles with sealing between the sheet piles and the piers, and discharge of water from the area between the cofferdam and the river bank.

The SWPPPs for this type of construction activities typically include methods to reduce turbidity during pier installation and pile driving within the Sacramento River, including measures to establish a rate of construction that would minimize turbidity and adverse effects on aquatic resources (see Chapter 12 Aquatic Biological Resources). Measures to minimize turbidity from discharges behind the cofferdam into the Sacramento River typically include withdrawals from the top of the water column to avoid discharge of sediment, and use of sediment basins or filters to remove sediment.

The SWPPPs typically include post-construction measures, including methods to remove the aboveground portions of the cofferdam and restore the riverbed in a manner that would not increase sediment or debris in the Sacramento River, and placement of erosion control measures on exposed soils on the river banks adjacent to the new facilities.

The SWPPPs typically include a monitoring and reporting program to the CVRWQCB that would address anticipated construction activities, including measures to contain all construction materials in a manner to avoid discharge of these materials into the waterways. The monitoring programs also would include rapid response and cleanup activities to address spills and accidents.

Summary

As described in Chapter 3 Description of the Sites Reservoir Alternatives, construction-related activities would be implemented in accordance with SWPPPs issued by the CVRWQCB to protect water quality. The SWPPPs would include monitoring and rapid response programs to address construction activities and unanticipated spills or accidents.

Therefore, impacts related to construction within natural surface water bodies under Alternative A would not be anticipated to cause or contribute to water quality degradation at the construction site or in the adjacent water bodies; therefore, the impact would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Construction within Man-made Surface Water Bodies

Construction activities within man-made surface water bodies include construction within Funks Reservoir and the GCID Main Canal that would require re-routing or cessation of existing flows into these facilities and removal of water around the construction areas. Dredging or excavation would occur within both facilities. Within the GCID Main Canal, construction activities would include construction of a new headgate structure, lining a portion of the canal, and replacement of a railroad siphon structure. Much of the construction at the Funks and Holthouse reservoir location and within the GCID Main Canal would occur on dry land areas described in the next subsection of this chapter.

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Construction within Funks Reservoir

Construction activities at the existing Funks Reservoir and the proposed Holthouse Reservoir would include diversion of flows into Funks Reservoir, partial dewatering of the existing reservoir, and dredging of accumulated sediment.

A bypass pipeline would be required to re-route water in the Tehama-Colusa Canal and in the upstream portion of Funks Creek around Funks Reservoir during construction. As described above for Construction within Natural Surface Water Bodies, the SWPPPs typically include requirements to divert stream flows around construction sites in temporary pipelines using methods to maintain flows and minimize sediment discharge into natural surface water bodies. The SWPPPs typically also include erosion control measures to minimize the amount of sediment that enters the natural surface water bodies (e.g., rapid grow grass seeds or geotechnical fabric) or silt fences.

It is anticipated that excavation and dredging of Funks Reservoir would occur during the portion of the year in which Funks Reservoir is dewatered and partially dredged as part of annual maintenance activities. As the reservoir is dewatered, the water to be discharged would be monitored and treated, if necessary, in accordance with typical SWPPP criteria issued by the CVRWQCB, to remove the sediment before discharging the flows into Funks Creek or other drainages.

Materials removed by dredging or excavation could be used as part of the earthwork construction at the Holthouse Reservoir or other locations, placed near the construction site, or removed offsite for disposal at permitted locations. Materials placed on or near the construction site and disturbed earth would be designed with temporary and long-term erosion control measures in accordance with typical SWPPP criteria. The SWPPPs for excavation sites typically include methods to reduce the amount of soil on trucks before they enter roads adjacent to the construction site, and methods to reduce soil or water in the dredged and excavated materials from leaving the trucks as the materials are transported on the roads.

Construction within the GCID Main Canal

Construction within the GCID Main Canal would occur during the annual maintenance periods when the canal is dewatered. Construction activities also would include installation of piers to anchor the headgate structure, grout injection of soils, and placement of concrete. The SWPPPs for this type of construction typically include methods to capture loose dirt from the construction activities to protect surface water bodies. Also included are measures to avoid spills of chemical constituents used during construction (e.g., grout, concrete, paint) in the canal to protect the future uses of GCID water and to protect nearby surface waters.

Summary

As described in Chapter 3 Description of the Sites Reservoir Alternatives, construction-related activities would be implemented in accordance with SWPPPs issued by the CVRWQCB to protect water quality.

The SWPPPs would include monitoring and rapid response programs to address construction activities and unanticipated spills or accidents.

Therefore, impacts related to construction within man-made surface water bodies under Alternative A would not be anticipated to cause or contribute to water quality degradation at the construction site or in the adjacent water bodies; therefore, the impact would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Construction on Currently Dry Land and Other General Construction Activities

The South Bridge, inlet/outlet structures at the dams, and portions of the dams' elevations higher than the surface water elevations of Funks and Stone Corral creeks would be constructed on dry land within the Sites Reservoir and TRR inundation areas. The springs at the Salt Lake within the Sites Reservoir would be grouted to reduce the seepage of saline water into Sites Reservoir.

Pipelines, tunnels, pumping/generating facilities, switchyards, electric overhead power lines, substations, roads and bridges, recreation facilities, field office maintenance yard, and buffer zones also would be constructed on dry land.

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Construction of New Facilities on Dry Land

Construction activities within the Sites Reservoir and TRR inundation areas would include clearing, grubbing, excavation, grading, and dewatering; construction of foundations for the South Bridge; and excavation, construction foundations, and placement of concrete and other materials at the inlet/outlet structures and the dam sites for the Golden Gate, Sites, and saddle dams at elevations higher than the surface water elevations of Funks and Stone Corral creeks.

Construction outside of the Sites Reservoir and TRR inundation areas would occur at the pumping/generating facilities, switchyards, pipelines, tunnels, permanent and temporary construction roads, bridges, recreation facilities (e.g., picnic areas, boat ramps, hiking trails), field office maintenance yard, and buffer zones. Construction activities at these locations would include clearing, grubbing, excavation, grading, other earthwork, groundwater dewatering, construction of structures using concrete and steel, placement of grout at the springs related to Salt Lake, and installation of fencing material around most facilities and along the buffer areas.

Excavation activities could range from shallow excavations at electrical switchyards to major excavations along the pipeline alignments. Excavated material, including tunnel muck, would be stockpiled within the construction disturbance area and managed using typical erosion control measures included in SWPPPs (e.g., covering of stockpiled material prior to rain events or in areas subject medium to high wind rates). Some of the excavated materials would be used to backfill pipeline trenches, construct dams, and provide for appropriate grade elevations at other locations. Remaining excavated materials would be spread on adjacent agricultural lands of willing landowners within a relatively narrow corridor along the pipeline alignment or placed in the Sites Reservoir inundation area. The SWPPPs typically require use of erosion control measures on disturbed earth to reduce wind and water erosion during and following construction (e.g., rapid grow grass seeds, geotechnical fabric, silt fences). As described in Chapter 3 Description of the Sites Reservoir Alternatives, vegetation would be established and maintained within the fence lines of all buffer zones to provide a fuelbreak from adjacent lands and to prevent wind and water erosion of the soils. The SWPPPs typically include measures to reduce the amount of soil on trucks before they enter roads adjacent to the construction site, and methods to reduce soil or water in the dredged and excavated materials from leaving the trucks as the materials are transported on the roads. The SWPPPs typically require monitoring of waters removed from the surface water or groundwater at the construction site, and use of sediment basins or filters to remove the sediment before discharging the flows into drainages near the construction sites.

The Field Office Maintenance Yard is anticipated to be used during construction for stockpiling and storage of construction materials and equipment, and for equipment maintenance. The materials stored at the Field Office Maintenance Yard also would include debris, concrete or other wastes to be removed from the construction sites, and other materials that would require hauling to permitted disposal sites. Construction of temporary and permanent roads, and parking areas at the dams, reservoirs, Delevan Inlet/Discharge Facilities, electrical switchyards, pumping/generating plants, Field Office Maintenance Yard, recreation sites, and construction staging areas would require extensive placement of asphalt. As described in Chapter 3 Description of the Sites Reservoir Alternatives, because of the large amount of paved areas and the remote location of the construction, it is anticipated that an asphalt batch plant would be built adjacent to the Field Office Maintenance Yard. The SWPPPs typically include measures to capture loose dirt, other material, and chemicals (e.g., paint, grout, concrete, or chemicals used in tunnel boring machines) from leaving the construction sites. Paints, other chemicals, fuel, oil, and equipment that contain fluids would be stored at the Field Office Maintenance Yard site during construction. The SWPPPs typically include criteria for boundary ditches or other isolation methods to be constructed at elevations above adjacent waterways to capture loose dirt or other material that could run off the site during rain events from construction sites that are used to stockpile materials, provide equipment maintenance, and store chemicals. The SWPPPs would include a monitoring and reporting program to the CVRWQCB that would address anticipated construction activities, as well as rapid response and cleanup responses to address spills and accidents.

The Field Office Maintenance Yard also would include a septic tank and leach field for wastewater disposal and a water supply. These facilities would be constructed in accordance with the SWRCB and Colusa County requirements in a manner to protect surface water and groundwater quality.

Summary

As described in Chapter 3 Description of the Sites Reservoir Alternatives, construction-related activities would be implemented in accordance with SWPPPs issued by the CVRWQCB to protect water quality. The SWPPPs would include monitoring and rapid response programs to address construction activities and unanticipated spills or accidents.

Therefore, impacts related to construction on dry land under Alternative A would not be anticipated to cause or contribute to water quality degradation at the construction site or in the adjacent water bodies; therefore, the impact would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Operations of Facilities within Surface Water Bodies

Facilities that would be operated within surface water bodies include Sites, Holthouse, and TRRs; Tehama-Colusa and GCID Main canals; and the Delevan Pipeline Intake/Discharge Facilities.

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Operations and Maintenance of Reservoirs, Canals, and the Delevan Pipeline Intake/Discharge Facilities

Maintenance activities at Sites, Holthouse, and TRRs would include debris and vegetation removal from the embankments, fence and sign maintenance, repair of embankments if erosion occurs, and inspection and maintenance of inlet/outlet facilities. It is anticipated that surface water elevations in Holthouse and TRRs would be reduced annually to allow for inspection and removal of excess sediment and other materials. These maintenance actions could require suction dredging or mechanical excavation around inlet/outlet structures or near the Golden Gate and Sites dams; dewatering; use of underwater dive crews; and use of boom trucks, rubber wheel cranes, and raft- or barge-mounted equipment. Flows would continue to be released from the reservoirs during maintenance activities. Materials removed from the reservoirs would be placed on land adjacent to the reservoirs within the buffer zones or hauled to permitted disposal locations. The outlet structures would be designed to reduce the possibility of discharging sediment into downstream water bodies; therefore, increased turbidity that would occur during maintenance activities would not increase sediment in downstream surface water bodies.

Existing operations and maintenance activities for the Tehama-Colusa and GCID Main canals would be continued, including sediment and debris removal in the canals; vegetation removal in the canal right-of-ways; periodic cleaning, painting, and motor control unit maintenance of equipment; and inspection and maintenance of fences and signs. The amount of sediment removed from the canals would be greater than under current operations because the canals would be operated for longer periods of time.

The reservoirs and canals would need to be operated in accordance with an SWPPP issued by the CVRWQCB. The SWPPPs typically include requirements that sediment and debris removed from the reservoirs and canals be removed, stored, and transported in a manner that does not increase turbidity or other water quality concerns in surface water bodies. The SWPPPs typically require erosion control measures for sediment or dredged materials placed in the buffer zones to avoid wind or water erosion, and measures for hauling these materials to permitted locations without increasing sediment or dust along the roads. The SWPPPs typically require use of chemicals (e.g., paint, erosion control materials) in a manner that does not degrade water quality of receiving waters.

Operations and Maintenance of Delevan Pipeline Intake/Discharge Facilities

Maintenance activities at the Delevan Pipeline Intake/Discharge Facilities would include debris and sediment removal. The intake screens would include automated equipment to reduce accumulation of sediment and debris from the waters of the Sacramento River from accumulating on the screens. The intake facility would not increase sediment, turbidity, or debris in the Sacramento River. Routine maintenance of the Delevan Pipeline Intake/Discharge Facilities would include debris and vegetation removal from the surrounding embankments, fence and sign maintenance, repair of embankments if erosion occurs, and painting of the structures. The maintenance actions would include use of suction dredging or mechanical dredging around the inlet/discharge facilities, use of underwater dive crews, and use of boom trucks, rubber wheel cranes, and raft- or barge-mounted equipment. Sediment removed from around the Delevan Pipeline Intake/Discharge Facilities would be placed in the buffer zone or hauled to a permitted disposal site.

The Delevan Pipeline Intake/Discharge Facilities would need to be operated in accordance with an SWPPP issued by the CVRWQCB that would require the removal of sediment and debris in a manner that does not increase turbidity or other water quality concerns in the Sacramento River. Operation of the Delevan Pipeline Intake/Discharge Facilities would need to include the use of erosion control measures for sediment or dredged materials placed in the buffer zones to avoid wind or water erosion of the materials, and measures for hauling sediment to permitted locations without increasing sediment or dust along the roads. The SWPPPs also would require use of chemicals (e.g., paint, erosion control materials) in a manner that does not degrade water quality of receiving waters.

Introduction of Saline Water into Sites Reservoir from Salt Lake

As described in Chapter 3 Description of the Sites Reservoir Alternatives, the springs that provide water to the Salt Lake would be grouted to reduce the amount of highly saline water from entering Sites Reservoir. However, the effectiveness of the grouting measures is not known at this time. Therefore, the water quality impact analysis for Sites Reservoir includes the following worst-case evaluation, assuming that salt water continues to enter the reservoir in a similar manner as historical seepage.

Based upon observations of the Salt Lake in 2017, it appears that the main body of Salt Lake is approximately 15 acres and could be 5 to 10 feet deep. These dimensions would result in a volume of 150 acre-feet. Evaporation rates for fresh water near Sites is approximately 5 feet/year, and saline water evaporates more slowly than fresh water. However, for this evaluation, the more conservative evaporation rate was assumed. To maintain the main body of the Salt Lake, approximately 75 acre-feet/year would need to seep from the springs into the Salt Lake (at a long-term average rate of 0.1 cfs).

As described in Section 7.2, Salt Lake becomes very small, especially in drier years. Therefore, it was assumed that seepage from the springs was very low in Dry and Critical water years.

The average monthly storage in Sites Reservoir under Alternative A in Wet, Above Normal, and Below Normal water years ranges from 800,000 to 1,050,000 acre-feet. The annual volume of saline water that currently seeps into Salt Lake would represent 0.008 to 0.009 percent of the total annual volume in Sites Reservoir under Alternative A. Assuming that the salinity of the water was an average of 7,200 µmhos/cm and the salinity of the Sacramento River water near Colusa was 170 µmhos/cm, the addition of the saline water that historically has formed Salt Lake would increase the overall salinity of Sites Reservoir by less than 1 µmhos/cm (0.4 percent).

Summary

As described in Chapter 3 Description of the Sites Reservoir Alternatives, operations and maintenance-related activities would be implemented in accordance with SWPPPs issued by the CVRWQCB to protect water quality. The SWPPPs would include monitoring and rapid response programs to address construction activities and unanticipated spills or accidents.

It is anticipated that the installation of grout in the springs that currently flow into Salt Lake would reduce the seepage of high salinity water into Sites Reservoir. However, if the seepage is not reduced, the continued seepage of the high salinity water would not affect the salinity in Sites Reservoir under Alternative A.

Therefore, impacts related to operations and maintenance within surface water bodies under Alternative A would not be anticipated to cause or contribute to water quality degradation; therefore, the impact would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Operations of Facilities on Dry Land

Facilities that would be operated on dry land include Golden Gate and Sites dams, saddle dams, pipelines, tunnels, pumping/generating plants, recreation facilities, roads, bridges, switchyards, overhead power lines, substations, the Field Office Maintenance Yard, and the buffer zones.

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General Operations and Maintenance Activities

Maintenance for the proposed facilities under Alternative A would consist of debris removal, vegetation control, rodent control, erosion control, routine maintenance (e.g., fence repairs, painting, cleaning, repairs, and other routine tasks to maintain facilities in accordance with design standards), landscape maintenance, and fuelbreak maintenance in the buffer zones and along pipeline alignments. These activities would require little to no ground disturbance.

Operations and maintenance of the facilities would be conducted in accordance with an SWPPP issued by the CVRWQCB. The SWPPPs typically include measures that address erosion control repairs, debris removal and disposal at permitted sites, and use of chemicals (e.g., paints and paving materials) in a manner to avoid degradation of water quality.

Operations and Maintenance Activities for Pumping Generating Plants, Switchyards and Overhead Power Lines, and Field Office Maintenance Yard

Routine maintenance and monitoring would occur for all gates, valves, pumps, and electrical equipment at the pumping/generating plants. The pumping/generating plants would include spill containment systems and hazardous materials storage sumps to avoid discharge of oil or other fluids from the equipment into receiving waters or onto adjacent lands.

Maintenance of the electrical switchyards and overhead power lines would include annual washing and cleaning of insulating equipment to remove dust.

Maintenance of the lands at the Field Office Maintenance Yard also would include periodic inspection and repair of wells, other water supply or treatment equipment, and septic systems; garbage and debris removal; and maintenance of supplies stocked at this location. Spare parts for mechanical and electrical equipment would be stored in the warehouse along with lubricants, oils, and greases to maintain equipment. Daily operations would include repairs and maintenance of equipment, and fueling and washing vehicles. The site would be operated in accordance with SWPPP criteria that would typically require spill containment systems and hazardous materials storage sumps to avoid discharge of oil or other fluids into receiving waters or onto adjacent lands. A spill protection plan and rapid response program would be established to protect adjacent water bodies and land from hazardous materials.

Operations and Maintenance Activities for Recreation Facilities

Maintenance of the recreational facilities would include landscape maintenance, periodic inspection and repair of water supply equipment, removal of garbage and debris, cleaning of restrooms or vault toilets, and stocking of supplies. During peak recreation use periods, these activities would likely occur more frequently than during the non-recreation periods.

It is anticipated that use of the recreational facilities for hiking, camping, picnicking, and swimming could result in increased erosion, accidental spills of hazardous or other materials, or introduction of detergents, sewage, or solid wastes to Sites Reservoir. However, the recreational facilities would include designated roads, trails, parking lots, campsites, beaches, day use areas, restrooms, and garbage containers to reduce the potential impacts of these activities. Sites Reservoir would not include marinas or boat fueling facilities, which would reduce the potential for fuel spills into the water. The sites would be operated in accordance with an SWPPP issued by the CVRWQCB.

Operations and Maintenance Activities for Roads and Bridges

Roads and bridges would require periodic removal of debris, cleanup of spills consisting of fuels and other chemicals from accidents, and cleaning and removal of sediment and debris. Roads would require periodic grading and resurfacing (for both paved and gravel roads), and earthwork along the road edges to repair eroded sites.

Use of the roads and South Bridge by recreational and local users could result in accidental fluid leaks or discharge of hazardous or other types of materials entering Sites Reservoir. Periodic road maintenance activities could result in highway surface materials entering Sites Reservoir. Debris collected along the roads would be hauled to a permitted location for disposal.

The roads would be maintained in accordance with SWPPPs issued by the CVRWQCB.

Summary

As described above and in Chapter 3 Description of the Sites Reservoir Alternatives, operations and maintenance-related activities would be implemented in accordance with SWPPPs issued by the CVRWQCB to protect water quality. The SWPPPs would include monitoring and rapid response programs to address construction activities and unanticipated spills or accidents.

Therefore, impacts related to operations and maintenance of facilities on dry land under Alternative A would not be anticipated to cause or contribute to water quality degradation; therefore, the impact would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

7.3.5 Impacts Associated with Alternative B

7.3.5.1 *Extended Study Area*

San Luis Reservoir

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Surface Water Elevations

Reservoir surface water level fluctuations can exacerbate the nuisance of algae blooms when reservoir levels are low because of increased nutrient concentration, reduced reservoir mixing, and higher water temperatures during low storage conditions. With implementation of Alternative B, San Luis Reservoir would continue to experience water level fluctuations as in the past. The difference between the long-term average surface water elevations for Alternative B and conditions under the Existing Conditions/No Project/No Action Condition would be less than 5 percent, as shown in Appendix 6B Water Resources System Modeling. Therefore, the potential for algal growth and associated water quality changes in

San Luis Reservoir under Alternative B would be similar to the Existing Conditions/No Project/No Action Condition, and would result in a **less-than-significant impact** under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Salinity

Salinity in San Luis Reservoir would be directly affected by salinity at the CVP Jones Pumping Plant and SWP Clifton Court Forebay (upstream of the SWP Banks Pumping Plant). Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar (within 5 percent) under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 5.8 percent higher under Alternative B, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir. Therefore, changes in salinity under Alternative B would result in a **less-than-significant impact** as compared to conditions under the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative B would result in similar potential for algal growth and associated water quality changes in San Luis Reservoir under Alternative B and the Existing Conditions/No Project/No Action Condition, and would result in a **less-than-significant impact** under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 5.8 percent higher under Alternative B. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir. Therefore, changes in salinity under Alternative B would result in a **less-than-significant impact** as compared to conditions under the Existing Conditions/No Project/No Action Condition.

7.3.5.2 *Secondary Study Area*

Trinity Lake, Trinity River Downstream of Trinity Lake and Lewiston Reservoir, and Klamath River Downstream of Trinity River

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Water Temperature

Water temperature modeling results under Alternative B are reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Trinity River downstream of Lewiston Dam, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures on the Trinity River are similar under Alternative B and the Existing Conditions/No Project/No Action Condition.

Because water temperatures in the lower Trinity River would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition, it is anticipated that implementation of

Alternative B would not result in increased water temperatures on the lower Klamath River under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury in the Trinity River watershed are located upstream of Trinity Lake and accumulate within Trinity Lake. The generation rate and the accumulation rates of mercury in Trinity Lake would not be affected by implementation of Alternative B because there would be no construction of new facilities upstream of Trinity Lake. Moreover, the operations of Trinity Lake, as reflected by end-of-month Trinity Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Because there would be no additional mercury accumulation in the Trinity River watershed, no additional mercury loadings would occur in the lower Klamath River from implementation of Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients and Dissolved Oxygen

Because there would be no construction in the Trinity River watershed under Alternative B, and operations of Trinity Lake would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition, no changes in nutrients and dissolved oxygen would be anticipated from implementation of Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

As described in Section 7.2, sources of nutrients and other constituents of concern that reduce dissolved oxygen in the lower Klamath River are located upstream of the confluence with Trinity River. Flows in the Trinity River would be similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources. Therefore, occurrence or concentrations of these constituents of concern would not be affected by implementation of Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative B would result in **less-than-significant impacts** on water temperatures in the Trinity River and the lower Klamath River downstream of the confluence with the Trinity River as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative B would result in **no impact** on mercury, nutrients, and dissolved oxygen in the Trinity River and the lower Klamath River as compared to the Existing Conditions/No Project/No Action Condition.

Clear Creek Downstream of Whiskeytown Lake

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative B would be either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on Clear Creek at Igo, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures on Clear

Creek downstream of Whiskeytown Lake would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury that are of concern in the Clear Creek watershed are located upstream of Whiskeytown Lake and accumulate within Whiskeytown Lake. The generation rate and the accumulation rates of mercury in Whiskeytown Lake would not be affected by implementation of Alternative B because there would be no construction of new facilities or changes in water supply facilities operations in the Clear Creek watershed as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative B would result in **less-than-significant impacts** on water temperatures in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative B would result in **no impact** on mercury concentrations in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Shasta Lake and Sacramento River from Shasta Lake and Keswick Reservoir to Freeport

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative B generally are either reduced or less than 0.5ºF higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Sacramento River between the Keswick Reservoir and Freeport, as shown in Appendix 7E River Temperature Modeling. However, in April and May in Below Normal, Dry, and Critical water years, water temperatures along the Sacramento River at Ball’s Ferry, Jelly’s Ferry, and Bend Bridge; downstream of the Tehama-Colusa Canal and GCID Main Canal intakes; and downstream of the Delevan Discharge Facilities under Alternative B would be 0.6 to 0.9°F higher as compared to the Existing Conditions/No Project/No Action Condition. The temperature values are less than 56°F (which is included in several water quality criteria as described in Section 7.2), except downstream of the GCID Main Canal intake near Hamilton City and the Delevan Discharge Facilities.

Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative B as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury and Other Heavy Metals

As described in Section 7.2, the sources of mercury and other heavy metals in Shasta Lake are located upstream of the lake and accumulate within Shasta Lake. Mercury in the Sacramento River downstream of Keswick Reservoir is generated along the tributaries to the Sacramento River. The generation rate and the accumulation rates of mercury and other heavy metals in Shasta Lake or along the Sacramento River would not be affected by implementation of Alternative B because there would be no new facilities constructed upstream of Shasta Lake or along the tributaries. Operations of Shasta Lake under Alternative B, as reflected by end-of-month Shasta Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Salinity

As shown in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes, salinity along the Sacramento River downstream of the Tehama-Colusa Canal and GCID Main Canal intakes and the proposed Delevan Pipeline Intake/Discharge Facilities would be similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative B would result in similar water temperatures in the Sacramento River between Keswick Reservoir and Freeport, except in April and May during Below Normal, Dry, and Critical water years when the average monthly water temperatures would increase between 0.6 and 0.9°F as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative B as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury, other heavy metals, and salinity would be similar in the Sacramento River under Alternative B as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Section 303 Lake Oroville, Thermalito Complex, and Feather River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative B are reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Feather River downstream of Lake Oroville, as shown in Appendix 7E River Temperature Modeling.

Mercury

As described in Section 7.2, the sources of mercury in Lake Oroville are located upstream of the lake and accumulate within Lake Oroville. The generation rate and the accumulation rates of mercury in Lake Oroville would not be affected by implementation of Alternative B because there would be no new facilities constructed upstream of Lake Oroville. Operations of Lake Oroville under Alternative B, as reflected by end-of-month Lake Oroville storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative B would result in reduced or similar water temperatures in the Feather River downstream of Lake Oroville as compared to the Existing Conditions/No Project/No Action

Condition. Therefore, changes in water temperatures in the Feather River under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, which would result in a **less-than-significant impact**.

Concentrations of mercury would be similar in the Feather River under Alternative B as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Folsom Lake, Lake Natoma, and American River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative B are generally reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition for the American River downstream of Lake Natoma, as shown in Appendix 7E River Temperature Modeling. However, in March in Critical water years, water temperatures under Alternative B along the lower American River would be up to 0.6°F higher as compared to the Existing Conditions/No Project/No Action Condition. Also, in June and July in Critical water years, water temperatures along the lower American River are up to 0.9°F higher under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative B as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury

As described in Section 7.2, the sources of mercury in the American River are located in the tributaries upstream and downstream of Folsom Lake and Lake Natoma. The generation rate and the accumulation rates of mercury in Folsom Lake, Lake Natoma, or in the lower American River would not be affected by implementation of Alternative B because there would be no new facilities constructed upstream of Folsom Lake and Lake Natoma or along the tributaries. Operations of Folsom Lake under Alternative B, as reflected by end-of-month Folsom Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative B would result in similar water temperatures in the American River downstream of Folsom Lake and Lake Natoma, except in July in Below Normal water years when the average monthly water temperatures would increase by up to 0.6ºF as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative B as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury would be similar in the lower American River under Alternative B as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Yolo Bypass

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Mercury

Water quality in the Yolo Bypass is related to water quality in the Sacramento River that flows directly into the bypass at the Fremont and Sacramento weirs, and water quality of flows from the Sutter Bypass that generally enter the Yolo Bypass at Fremont Weir. As described in Section 7.2, water quality concerns in the Yolo Bypass are primarily related to mercury that results in methylmercury production in the inundated areas. Therefore, reductions in inundated areas, especially in the wetter years in the Yolo Bypass, could result in similar methylmercury generation rates.

To analyze potential increases in inundated areas, the total flow discharged from the Yolo Bypass was modeled at the southern boundary of the bypass as the flows enter the Sacramento River near Rio Vista. During the summer and fall months, Yolo Bypass flows remain in the defined water bodies, including the Tule Canal and the Toe Drain. However, as water enters the bypass in the winter and spring months, the water flows into the agricultural and habitat areas that are only periodically inundated.

As shown in Appendix 6B Water Resources System Modeling, flows in the winter and spring months (December through May) from the Yolo Bypass into the Sacramento River under Alternative B would be reduced or similar as compared to the Existing Conditions/No Project/No Action Condition. This would occur because water would be diverted into Sites Reservoir during this period. Therefore, the potential for inundation of land adjacent to the defined water bodies and the potential for increased generation of methylmercury would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Other sources of mercury in the Yolo Bypass, including Putah Creek, which is tributary to the bypass, would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition.

Summary

Yolo Bypass flows would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition; therefore, the potential for increased occurrence of methylmercury oxidation in the Yolo Bypass under Alternative B would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Delta

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Inflow from the San Joaquin River into the Delta under Alternative B would be the same as that under the Existing Conditions/No Project/No Action Condition. However, inflows from the Sacramento River and export patterns at the CVP and SWP pumping plants would be different under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. The changes in flows would result in changes in salinity as indicated in Appendix 7D Sacramento-San Joaquin Delta Modeling.

Salinity at Emmaton would be reduced or similar, except in December in Above Normal water years and in January and February in Critical water years under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity at Jersey Point would be reduced or similar under Alternative B, except from October through December in Wet and Above Normal water years and in September and February in Critical water years, as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity would be reduced or similar during the compliance period of April 1 through August 15 required under the SWRCB Decision 1641 under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the SWP intake at the SWP North Bay Aqueduct and at the CCWD intake along Victoria Canal and Old River would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the CVP Rock Slough intake, which provides water to CCWD, would be reduced or similar under Alternative B, except during November and December in Above Normal water years when salinity would increase up to 17.5 percent. However, salinity during these months would be consistent with SWRCB Decision 1641 criteria.

Salinity at the CVP Jones Pumping Plant intake and SWP Clifton Court Forebay intake (upstream of the SWP Banks Pumping Plant) would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, except in November in Above Normal water years at Clifton Court Forebay when the salinity would be 5.8 percent higher under Alternative B, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for CVP and SWP intakes.

Mercury

As described in Section 7.2, the primary sources of mercury in the Delta are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in the Delta would be similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Within the Delta, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in the Delta under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Delta (effluent discharges and organic growths in the water) would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition. Also, the dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar. Because these conditions would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition, the potential for *Microcystis* growth also would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Dissolved oxygen concentrations are also affected by reductions in Delta outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur in November or December at the CVP Rock Slough intake and the Clifton Court Forebay. EC during these months with salinity increases would not exceed SWRCB Decision 1641 criteria. Therefore, the overall changes in salinity in the Delta under Alternative B would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in the Delta under Alternative B would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Suisun Bay and Suisun Marsh

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Alternative B would result in changes in inflow patterns into Suisun Bay, Suisun Marsh, and San Francisco Bay as compared to the Existing Conditions/No Project/No Action Condition. Salinity in Suisun Bay would be reduced or similar in the summer and fall months at Collinsville near the confluence of the Sacramento and San Joaquin rivers, Mallard Slough, and Port Chicago under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity at Collinsville under Alternative B would increase from December through March in Above Normal water years, January and March in Below Normal water years, March and April in Dry water years, and January through March in Critical water years as compared to the Existing Conditions/No Project/No Action Condition. Similar changes in salinity occur in the winter months at Mallard Slough and Port Chicago, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling.

The X2 position in the western Delta and Suisun Bay would be similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling.

Mercury

As described in Section 7.2, the primary sources of mercury in Suisun Bay and Suisun Marsh are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in Suisun Bay and Suisun Marsh would be similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Within Suisun Bay and Suisun Marsh, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in Suisun Bay and Suisun Marsh under Alternative B as compared to the Existing Conditions/ No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Suisun Bay and Suisun Marsh would be similar under Alternative B and the Existing Conditions/No Project/No Action Condition. Also, the dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar.

Dissolved oxygen concentrations are also affected by reductions in Suisun Bay and Suisun Marsh outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity in the summer and fall months would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur from December through April when Delta outflow declines as water is diverted into Sites Reservoir. The salinity would continue to be consistent with SWRCB Decision 1641 criteria during those months. Therefore, overall changes in salinity in Suisun Bay and Suisun Marsh under Alternative B would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative B as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in Suisun Bay and Suisun Marsh under Alternative B would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

7.3.5.3 *Primary Study Area*

Construction, Operation, and Maintenance Impacts

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The construction, operations, and maintenance activities in the Primary Study Area under Alternative B would be the same as those described under Alternative A, except that Delevan Pipeline Discharge

Facilities would be smaller because it would not include fish screen or intake facilities, and Sites Reservoir would be larger. Construction of the Delevan Pipeline Discharge Facilities under Alternative B would require similar construction, operations, and maintenance activities as those for the Delevan Pipeline Intake/Discharge Facilities under Alternative A.

Refer to **Impact SW Qual-1** discussion under Alternative A for construction, operations, and maintenance impacts under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

Under Alternative B, the extent of the construction disturbance areas of Sites Reservoir dams, roads, bridges, overhead power lines, and the buffer zones would differ from those of Alternative A. However, these differences in the size of the facility footprint, alignment, or construction disturbance area would not change the type of construction, operation, and maintenance activities that were described for Alternative A.

Under Alternative B, the potential for changes in salinity in Sites Reservoir related to potential seepage from the springs near Salt Lake (if the grout seal does not reduce seepage) would result in an increase in EC of less than 0.5 μmhos/cm (0.2 percent). The high salinity water from the Salt Lake area would represent less than 0.005 to 0.75 percent of the total water in Sites Reservoir under Alternative B.

Therefore, Alternative B would have the same potential for surface water quality changes as described for Alternative A (**Impact SW Qual-1**) and result in a **less-than-significant impact** under Alternative B as compared to the Existing Conditions/No Project/No Action Condition.

7.3.6 Impacts Associated with Alternative C

7.3.6.1 *Extended Study Area*

San Luis Reservoir

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Surface Water Elevations

Reservoir surface water level fluctuations can exacerbate the nuisance of algae blooms when reservoir levels are low because of increased nutrient concentration, reduced reservoir mixing, and higher water temperatures during low storage conditions. With implementation of Alternative C, San Luis Reservoir would continue to experience water level fluctuations as in the past. The difference between the long-term average surface water elevations for Alternative C and conditions under the Existing Conditions/No Project/No Action Condition would be less than 5 percent, as shown in Appendix 6B Water Resources System Modeling. Therefore, the potential for algal growth and associated water quality changes in San Luis Reservoir under Alternative C would be similar to the Existing Conditions/No Project/No Action Condition.

Salinity

Salinity in San Luis Reservoir would be directly affected by salinity at the CVP Jones Pumping Plant and SWP Clifton Court Forebay (upstream of the SWP Banks Pumping Plant). Under Alternative C, salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar (within 5 percent) as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above

Normal water years at Clifton Court Forebay when the salinity would be 7.3 percent higher under Alternative C, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir.

Summary

Implementation of Alternative C would result in a similar potential for algal growth and associated water quality changes in San Luis Reservoir as compared to the Existing Conditions/No Project/No Action Condition, and would result in a **less-than-significant impact** under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the Jones Pumping Plant and Clifton Court Forebay would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 7.3 percent higher under Alternative C. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir. Therefore, changes in salinity under Alternative C would result in a **less-than-significant impact** as compared to conditions under the Existing Conditions/No Project/No Action Condition.

7.3.6.2 *Secondary Study Area*

Trinity Lake, Trinity River Downstream of Trinity Lake and Lewiston Reservoir, and Klamath River Downstream of Trinity River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative C are either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Trinity River downstream of Lewiston Dam, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures in the Trinity River are similar under Alternative C and the Existing Conditions/No Project/No Action Condition.

Because water temperatures in the lower Trinity River would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition, it is anticipated that implementation of Alternative C would not result in increased water temperatures in the lower Klamath River under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury in the Trinity River watershed are located upstream of Trinity Lake and accumulate within Trinity Lake. The generation rate and the accumulation rates of mercury in Trinity Lake would not be affected by implementation of Alternative C because there would be no construction of new facilities upstream of Trinity Lake. The operations of Trinity Lake under Alternative C, as reflected by end-of-month Trinity Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Because there would be no additional mercury accumulation in the Trinity River watershed, no additional mercury loadings would occur in the lower Klamath River from implementation of Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients and Dissolved Oxygen

Because there would be no construction in the Trinity River watershed under Alternative C and operations of Trinity Lake would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition, no changes in nutrients and dissolved oxygen would be anticipated from implementation of Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

As described in Section 7.2, sources of nutrients and other constituents of concern that reduce dissolved oxygen in the lower Klamath River are located upstream of the confluence with Trinity River. Flows in the Trinity River would be similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources. Therefore, the occurrence or concentrations of these constituents of concern would not be affected by implementation of Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative C would result in **less-than-significant impacts** on water temperatures in the Trinity River and the lower Klamath River downstream of the confluence with the Trinity River as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative C would result in **no impact** on mercury, nutrients, and dissolved oxygen in the Trinity River and the lower Klamath River as compared to the Existing Conditions/No Project/No Action Condition.

Clear Creek Downstream of Whiskeytown Lake

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative C would be either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on Clear Creek at Igo, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures in Clear Creek downstream of Whiskeytown Lake would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury that are of concern in the Clear Creek watershed are located upstream of Whiskeytown Lake and accumulate within Whiskeytown Lake. The generation rate and the accumulation rates of mercury in Whiskeytown Lake would not be affected by implementation of Alternative C because there would be no construction of new facilities or changes in water supply facilities operations in the Clear Creek watershed as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative C would result in **less-than-significant impacts** on water temperatures in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative C would result in **no impact** on mercury concentrations in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Shasta Lake and Sacramento River from Shasta Lake and Keswick Reservoir to Freeport

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative C generally are either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition in the Sacramento River between the Keswick Reservoir and Freeport, as shown in Appendix 7E River Temperature Modeling. However, in April and May in Below Normal, Dry, and Critical water years, water temperatures along the Sacramento River at Ball's Ferry, Jelly's Ferry, and Bend Bridge; downstream of the Tehama-Colusa Canal and GCID Main Canal intakes; and downstream of the Delevan Pipeline Intake/Discharge Facilities, temperatures under Alternative C would be 0.6 to 1°F higher as compared to the Existing Conditions/No Project/No Action Condition. The temperature values are less than 56°F (which is included in several water quality criteria as described in Section 7.2), except downstream of the GCID Main Canal intake near Hamilton City and the Delevan Pipeline Intake/Discharge Facilities.

Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative C as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury and Other Heavy Metals

As described in Section 7.2, the sources of mercury and other heavy metals in Shasta Lake are located upstream of the lake and accumulate within Shasta Lake. Mercury in the Sacramento River downstream of Keswick Reservoir is generated along the tributaries to the Sacramento River. The generation rate and the accumulation rates of mercury and other heavy metals in Shasta Lake or along the Sacramento River would not be affected by implementation of Alternative C because there would be no new facilities constructed upstream of Shasta Lake or along the tributaries. Operations of Shasta Lake under Alternative C, as reflected by end-of-month Shasta Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Salinity

As shown in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes, salinity along the Sacramento River downstream of the Tehama-Colusa Canal and GCID Main Canal intakes and the proposed Delevan Pipeline Intake/Discharge Facilities would be similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative C would result in similar water temperatures in the Sacramento River between Keswick Reservoir and Freeport, except in April and May during Below Normal, Dry, and Critical water years when the average monthly water temperatures would increase between 0.6 and 1°F as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative C as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury, other heavy metals, and salinity would be similar in the Sacramento River under Alternative C as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Section 303 Lake Oroville, Thermalito Complex, and Feather River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative C are reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition in the Feather River downstream of Lake Oroville, as shown in Appendix 7E River Temperature Modeling.

Mercury

As described in Section 7.2, the sources of mercury in Lake Oroville are located upstream of the lake and accumulate within Lake Oroville. The generation rate and the accumulation rates of mercury in Lake Oroville would not be affected by implementation of Alternative C because there would be no new facilities constructed upstream of Lake Oroville. Operations of Lake Oroville, as reflected by end-of-month Lake Oroville storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative C would result in reduced or similar water temperatures in the Feather River downstream of Lake Oroville as compared to the Existing Conditions/No Project/No Action Condition. Therefore, changes in water temperatures in the Feather River under Alternative C as compared to the Existing Conditions/No Project/No Action Condition would result in a **less-than-significant impact**.

Concentrations of mercury would be similar in the Feather River under Alternative C as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Folsom Lake, Lake Natoma, and American River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative C are generally reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition for the American River downstream of Lake Natoma, as shown in Appendix 7E River Temperature Modeling. However, in April in Critical water years, water temperatures along the lower American River are up to 0.7°F higher under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Also, in June in Dry water years, water temperatures along the lower American River are up to 0.7°F higher under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative C as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury

As described in Section 7.2, the sources of mercury in the American River are located in the tributaries upstream and downstream of Folsom Lake and Lake Natoma. The generation rate and the accumulation rates of mercury in Folsom Lake, Lake Natoma, or in the lower American River would not be affected by implementation of Alternative C because there would be no new facilities constructed upstream of Folsom Lake and Lake Natoma or along the tributaries. Operations of Folsom Lake under Alternative C, as reflected by end-of-month Folsom Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative C would result in similar water temperatures in the American River downstream of Folsom Lake and Lake Natoma, except in July in Below Normal water years when the average monthly water temperatures would increase by up to 0.8ºF as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative C as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury would be similar in the lower American River under Alternative C as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Yolo Bypass

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Mercury

Water quality in the Yolo Bypass is related to water quality in the portion of the Sacramento River that flows directly into the bypass at the Fremont and Sacramento weirs, and water quality of flows from the Sutter Bypass that generally enter the Yolo Bypass at Fremont Weir. As described in Section 7.2, water quality concerns in the Yolo Bypass are primarily related to mercury that results in methylmercury production in the inundated areas. Therefore, reductions in inundated areas, especially in the wetter years in the Yolo Bypass, could result in similar methylmercury generation rates.

To analyze potential increases in inundated areas, the total flow discharged from the Yolo Bypass was modeled at the southern boundary of the bypass as the flows enter the Sacramento River near Rio Vista. During the summer and fall months, Yolo Bypass flows remain in the defined water bodies, including the Tule Canal and the Toe Drain. However, as water enters the bypass in the winter and spring months, the water flows into the agricultural and habitat areas that are only periodically inundated.

As shown in Appendix 6B Water Resources System Modeling, flows in the winter and spring months (December through May) from the Yolo Bypass into the Sacramento River under Alternative C would be reduced or similar as compared to the Existing Conditions/No Project/No Action Condition. This would occur because water would be diverted into Sites Reservoir during this period. Therefore, the potential for inundation of land adjacent to the defined water bodies and the potential for increased generation of methylmercury would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Other sources of mercury in the Yolo Bypass, including Putah Creek, which is tributary to the bypass, would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition.

Summary

Yolo Bypass flows would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition; therefore, the potential for increased occurrence of methylmercury oxidation in the Yolo Bypass under Alternative C would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Delta

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Inflow from the San Joaquin River into the Delta under Alternative C would be the same as that under the Existing Conditions/No Project/No Action Condition. However, inflows from the Sacramento River and export patterns at the CVP and SWP pumping plants would be different under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. The changes in flows would result in changes in salinity, as indicated in Appendix 7D Sacramento-San Joaquin Delta Modeling.

Salinity at Emmaton and Jersey Point would be reduced or similar, except in January and February in Critical water years under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity would be reduced or similar during the compliance period of April 1 through August 15, required under the SWRCB Decision 1641, under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the SWP intake at the SWP North Bay Aqueduct and at the CCWD intake along Victoria Canal would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the CVP Rock Slough intake, which provides water to CCWD, would be reduced or similar under Alternative C, except during November and December in Above Normal water years when salinity would increase up to 20.7 percent.

Salinity at the CCWD intake on Old River also would be reduced or similar under Alternative C, except during November and December in Above Normal water years when salinity would increase up to 11.9 percent. However, salinity during these months would be consistent with SWRCB Decision 1641 criteria.

Salinity at the CVP Jones Pumping Plant intake and SWP Clifton Court Forebay intake (upstream of the SWP Banks Pumping Plant) would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, except in November and December in Above Normal water years at Clifton Court Forebay when the salinity would be 7.3 percent higher under Alternative C, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for CVP and SWP intakes.

Mercury

As described in Section 7.2, the primary sources of mercury in the Delta are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in the Delta would be similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Within the Delta, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in the Delta under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Delta (effluent discharges and organic growths in the water) would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition. Also, the dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar. Because these conditions would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition, the potential for *Microcystis* growth also would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Dissolved oxygen concentrations are also affected by reductions in Delta outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur in November and December at the CVP Rock Slough intake, at the CCWD intake on Old River, and at Clifton Court Forebay. EC during these months with salinity increases would not exceed SWRCB Decision 1641 criteria. Therefore, the overall changes in salinity in the Delta under Alternative C would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in the Delta under Alternative C would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Suisun Bay and Suisun Marsh

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Alternative C would result in changes in inflow patterns into Suisun Bay, Suisun Marsh, and San Francisco Bay as compared to the Existing Conditions/No Project/No Action Condition. Salinity in Suisun Bay would be reduced or similar in the summer and fall months at Collinsville near the confluence of the Sacramento and San Joaquin rivers, Mallard Slough, and Port Chicago under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity at Collinsville under Alternative C would increase from December through March in Above Normal water years, January through March in Below Normal and Critical water years, and March and April in Dry water years as compared to the Existing Conditions/No Project/No Action Condition. Similar changes in salinity occur in the winter months at Mallard Slough and Port Chicago, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling.

The X2 position in the western Delta and Suisun Bay would be similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling.

Mercury

As described in Section 7.2, the primary sources of mercury in Suisun Bay and Suisun Marsh are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in Suisun Bay and Suisun Marsh would be similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Within Suisun Bay and Suisun Marsh, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in Suisun Bay and Suisun Marsh under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Suisun Bay and Suisun Marsh would be similar under Alternative C and the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar.

Dissolved oxygen concentrations are also affected by reductions in Suisun Bay and Suisun Marsh outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative C as compared to the Existing Conditions/ No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity in the summer and fall months would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur from December through April when Delta outflow declines as water is diverted into Sites Reservoir. The salinity would continue to be consistent with SWRCB Decision 1641 criteria during those months. Therefore, overall changes in salinity in Suisun Bay and Suisun Marsh under Alternative C would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative C as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in Suisun Bay and Suisun Marsh under Alternative C would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

7.3.6.3 *Primary Study Area*

Construction, Operation, and Maintenance Impacts

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The construction, operations, and maintenance activities in the Primary Study Area under Alternative C would be the same as those described under Alternative A, except that Sites Reservoir would be larger.

Refer to **Impact SW Qual-1** discussion under Alternative A for construction, operations, and maintenance impacts under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

Under Alternative C, the potential for changes in salinity in Sites Reservoir related to potential seepage from the springs near Salt Lake (if the grout seal does not reduce seepage) would result in an increase in EC of less than 0.5 µmhos/cm (0.2 percent). The high salinity water from the Salt Lake area would represent less than 0.005 to 0.75 percent of the total water in Sites Reservoir under Alternative B.

Therefore, Alternative C would have the same potential for surface water quality changes as those described for Alternative A (**Impact SW Qual-1**) and would result in a **less-than-significant impact** under Alternative C as compared to the Existing Conditions/No Project/No Action Condition.

7.3.7 Impacts Associated with Alternative D

7.3.7.1 *Extended Study Area*

San Luis Reservoir

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Surface Water Elevations

Reservoir surface water level fluctuations can exacerbate the nuisance of algae blooms when reservoir levels are low because of increased nutrient concentration, reduced reservoir mixing, and higher water temperatures during low storage conditions. With implementation of Alternative D, San Luis Reservoir would continue to experience water level fluctuations as in the past. The difference between the long-term average surface water elevations for Alternative D and conditions under the Existing Conditions/No Project/No Action Condition would be less than 5 percent, as shown in Appendix 6B Water Resources System Modeling. Therefore, the potential for algal growth and associated water quality changes in San Luis Reservoir under Alternative D would be similar to the Existing Conditions/No Project/No Action Condition.

Salinity

Salinity in San Luis Reservoir would be directly affected by salinity at the CVP Jones Pumping Plant and SWP Clifton Court Forebay (upstream of the SWP Banks Pumping Plant). Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar (within 5 percent) under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 6.8 percent higher under Alternative D, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir.

Summary

Implementation of Alternative D would result in a similar potential for algal growth and associated water quality changes in San Luis Reservoir and the Existing Conditions/No Project/No Action Condition, and would result in a **less-than-significant impact** under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at Jones Pumping Plant and Clifton Court Forebay would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, except in November of Above Normal water years at Clifton Court Forebay when the salinity would be 6.8 percent higher under Alternative D. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for San Luis Reservoir. Therefore, changes in salinity under Alternative D would result in a **less-than-significant impact** as compared to conditions under the Existing Conditions/No Project/No Action Condition.

7.3.7.2 *Secondary Study Area*

Trinity Lake, Trinity River Downstream of Trinity Lake and Lewiston Reservoir, and Klamath River Downstream of Trinity River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative D are either reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition in the Trinity River downstream of Lewiston Dam, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures on the Trinity River are similar under Alternative D and the Existing Conditions/ No Project/No Action Condition.

Because water temperatures in the lower Trinity River would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition, it is anticipated that implementation of Alternative D would not result in increased water temperatures in the lower Klamath River as compared to the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury in the Trinity River watershed are located upstream of Trinity Lake and accumulate within Trinity Lake. The generation rate and the accumulation rates of mercury in Trinity Lake would not be affected by implementation of Alternative D because there would be no construction of new facilities upstream of Trinity Lake. The operations of Trinity Lake under Alternative D, as reflected by end-of-month Trinity Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Because there would be no additional mercury accumulation in the Trinity River watershed, no additional mercury loadings would occur in the lower Klamath River from implementation of Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients and Dissolved Oxygen

Because there would be no construction in the Trinity River watershed under Alternative D and operations of Trinity Lake would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition, no changes in nutrients and dissolved oxygen would be anticipated from implementation of Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

As described in Section 7.2, sources of nutrients and other constituents of concern that reduce dissolved oxygen in the lower Klamath River are located upstream of the confluence with Trinity River. Flows in the Trinity River would be similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources. Therefore, occurrence or concentrations of these constituents of concern would not be affected by implementation of Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative D would result in **less-than-significant impacts** on water temperatures in the Trinity River and the lower Klamath River downstream of the confluence with the Trinity River as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative D would result in **no impact** on mercury, nutrients, and dissolved oxygen in the Trinity River and the lower Klamath River as compared to the Existing Conditions/No Project/No Action Condition.

Clear Creek Downstream of Whiskeytown Lake

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative D would be either reduced or less than 0.5ºF higher than water temperatures under the Existing Conditions/No Project/No Action Condition in Clear Creek at Igo, as shown in Appendix 7E River Temperature Modeling. Therefore, the water temperatures in Clear Creek downstream of Whiskeytown Lake would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition.

Mercury

As described in Section 7.2, the sources of mercury that are of concern in the Clear Creek watershed are located upstream of Whiskeytown Lake and accumulate within Whiskeytown Lake. The generation rate and the accumulation rates of mercury in Whiskeytown Lake would not be affected by implementation of Alternative D because there would be no construction of new facilities or changes in water supply facilities operations in the Clear Creek watershed as compared to the Existing Conditions/No Project/ No Action Condition.

Summary

Implementation of Alternative D would result in **less-than-significant impacts** on water temperatures in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Implementation of Alternative D would result in **no impact** on mercury concentrations in Clear Creek as compared to the Existing Conditions/No Project/No Action Condition.

Shasta Lake and Sacramento River from Shasta Lake and Keswick Reservoir to Freeport

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative D generally are either reduced or less than 0.5ºF higher than water temperatures under the Existing Conditions/No Project/No Action Condition in the portion of the Sacramento River between the Keswick Reservoir and Freeport, as shown in Appendix 7E River Temperature Modeling. However, in April in Below Normal, Dry, and Critical water years, water temperatures along the Sacramento River at Ball's Ferry, Jelly's Ferry, and Bend Bridge; downstream of the Tehama-Colusa Canal and GCID Main Canal intakes; and downstream of the Delevan Pipeline Intake/Discharge Facilities under Alternative D would be 0.6 to 0.9°F higher as compared to the Existing Conditions/No Project/No Action Condition. The temperature values are less than 56°F (which is included in several water quality criteria as described in Section 7.2), except downstream of the Tehama-Colusa Canal intake near Hamilton City and the Delevan Pipeline Intake/Discharge Facilities.

Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative D as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury and Other Heavy Metals

As described in Section 7.2, the sources of mercury and other heavy metals in Shasta Lake are located upstream of the lake and accumulate within Shasta Lake. Mercury in the Sacramento River downstream of Keswick Reservoir is generated along the tributaries to the Sacramento River. The generation rate and the accumulation rates of mercury and other heavy metals in Shasta Lake or along the Sacramento River would not be affected by implementation of Alternative D because there would be no new facilities constructed upstream of Shasta Lake or along the tributaries. Operations of Shasta Lake under Alternative D, as reflected by end-of-month Shasta Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Salinity

As shown in Appendix 7C Surface Water Quality Analysis for Electrical Conductivity at Proposed Intakes, salinity along the Sacramento River downstream of the Tehama-Colusa Canal and GCID Main Canal intakes and the proposed Delevan Pipeline Intake/Discharge Facilities would be similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Implementation of Alternative D would result in similar water temperatures in the portion of the Sacramento River between Keswick Reservoir and Freeport, except in April during Below Normal, Dry, and Critical water years when the average monthly water temperatures would increase between 0.6 and 0.9°F as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the Sacramento River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative D as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury, other heavy metals, and salinity would be similar in the Sacramento River under Alternative D as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Lake Oroville, Thermalito Complex, and Feather River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative D are reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition on the Feather River downstream of Lake Oroville, as shown in Appendix 7E River Temperature Modeling.

Mercury

As described in Section 7.2, the sources of mercury in Lake Oroville are located upstream of the lake and accumulate within Lake Oroville. The generation rate and the accumulation rates of mercury in Lake Oroville would not be affected by implementation of Alternative D because there would be no new facilities constructed upstream of Lake Oroville. Operations of Lake Oroville under Alternative D, as reflected by end-of-month Lake Oroville storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as shown in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative D would result in reduced or similar water temperatures in the Feather River downstream of Lake Oroville as compared to the Existing Conditions/No Project/No Action Condition. Therefore, changes in water temperatures in the Feather River under Alternative D as compared to the Existing Conditions/No Project/No Action Condition would result in a **less-than-significant impact**.

Concentrations of mercury would be similar in the Feather River under Alternative D as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Folsom Lake, Lake Natoma, and American River

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Water Temperature

Water temperature modeling results under Alternative D are generally reduced or less than 0.5°F higher than water temperatures under the Existing Conditions/No Project/No Action Condition for the American River downstream of Lake Natoma, as shown in Appendix 7E River Temperature Modeling. However, in June in Dry water years, water temperatures along the lower American River are up to 0.6°F higher under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative D as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Mercury

As described in Section 7.2, the sources of mercury in the American River are located in the tributaries upstream and downstream of Folsom Lake and Lake Natoma. The generation rate and the accumulation rates of mercury in Folsom Lake, Lake Natoma, or in the lower American River would not be affected by implementation of Alternative D because there would be no new facilities constructed upstream of Folsom Lake and Lake Natoma or along the tributaries. Operations of Folsom Lake under Alternative D, as reflected by end-of-month Folsom Lake storage, would be similar to conditions under the Existing Conditions/No Project/No Action Condition, as described in Chapter 6 Surface Water Resources.

Summary

Implementation of Alternative D would result in similar water temperatures in the American River downstream of Folsom Lake and Lake Natoma, except in July in Below Normal water years when the average monthly water temperatures would increase by up to 0.7°F compared to the Existing Conditions/No Project/No Action Condition. Potential impacts of changes in water temperatures in the lower American River would be associated with changes to aquatic resources, which are addressed in Chapter 12 Aquatic Biological Resources. Therefore, potential impacts and related mitigation measures associated with changes in water temperatures under Alternative D as compared to the Existing Conditions/No Project/No Action Condition are presented in Chapter 12 Aquatic Biological Resources.

Concentrations of mercury would be similar in the lower American River under Alternative D as compared to the Existing Conditions/No Project/No Action Condition; therefore, there would be **no impact** related to these constituents.

Yolo Bypass

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Mercury

Water quality in the Yolo Bypass is related to water quality in the portion of the Sacramento River that flows directly into the bypass at the Fremont and Sacramento weirs, and water quality of flows from the Sutter Bypass that generally enter the Yolo Bypass at Fremont Weir. As described in Section 7.2, water quality concerns in the Yolo Bypass are primarily related to mercury that results in methylmercury production in the inundated areas. Therefore, reductions in inundated areas, especially in the wetter years in the Yolo Bypass, could result in similar methylmercury generation rates.

To analyze potential increases in inundated areas, the total flow discharged from the Yolo Bypass was modeled at the southern boundary of the bypass as the flows enter the Sacramento River near Rio Vista. During the summer and fall months, Yolo Bypass flows remain in the defined water bodies, including the Tule Canal and the Toe Drain. However, as water enters the bypass in the winter and spring months, the water flows into the agricultural and habitat areas that are only periodically inundated.

As shown in Appendix 6B Water Resources System Modeling, flows in the winter and spring months (December through May) from the Yolo Bypass into the Sacramento River under Alternative D would be reduced or similar as compared to the Existing Conditions/No Project/No Action Condition. This would occur because water would be diverted into Sites Reservoir during this period. Therefore, the potential for inundation of land adjacent to the defined water bodies and the potential for increased generation of methylmercury would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Other sources of mercury in the Yolo Bypass, including Putah Creek, which is tributary to the bypass, would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition.

Summary

Yolo Bypass flows would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition; therefore, the potential for increased occurrence of methylmercury oxidation in the Yolo Bypass under Alternative D would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Delta

Impact SW Qual-1: A Violation of Any Water Quality Standard or Waste Discharge Requirement, or Otherwise Substantially Degrade Surface Water Quality

Salinity

Inflow from the San Joaquin River into the Delta under Alternative D would be the same as that under the Existing Conditions/No Project/No Action Condition. However, inflows from the Sacramento River and export patterns at the CVP and SWP pumping plants would be different under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. The changes in flows would result in changes in salinity as indicated in Appendix 7D Sacramento-San Joaquin Delta Modeling.

Salinity at Emmaton would be reduced or similar under Alternative D, except in January and February in Critical water years as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity at Jersey Point would be reduced or similar, except in October and November of Wet water years, October through December of Above Normal water years, and January through March in Critical water years under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity would be reduced or similar during the compliance period of April 1 through August 15, required under the SWRCB Decision 1641, under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the SWP intake at the SWP North Bay Aqueduct and at the CCWD intake along Victoria Canal would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Salinity at the CVP Rock Slough intake, which provides water to CCWD, would be reduced or similar under Alternative D, except during November in Wet water years, November through January in Above Normal water years, December in Dry water years, and February of Critical water years when salinity would increase up to 18.5 percent.

Salinity at the CCWD intake on Old River also would be reduced or similar under Alternative D, except from November through January in Above Normal water years when salinity would increase up to 10.6 percent. However, salinity during these months would be consistent with SWRCB Decision 1641 criteria.

Salinity at the CVP Jones Pumping Plant intake and SWP Clifton Court Forebay intake (upstream of the SWP Banks Pumping Plant) would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, except in November in Above Normal water years at Clifton Court Forebay when the salinity would be 6.8 percent higher under Alternative D, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. Salinity changes between 5 and 10 percent would not be considered potentially significant unless there was an increased potential for violation of water quality criteria. No such criteria exist for CVP and SWP intakes.

Mercury

As described in Section 7.2, the primary sources of mercury in the Delta are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in the Delta would be similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. Within the Delta, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in the Delta under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Delta (effluent discharges and organic growths in the water) would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar. Because these conditions would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition, the potential for *Microcystis* growth also would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition.

Dissolved oxygen concentrations are also affected by reductions in Delta outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur in November or December at the CVP Rock Slough intake, at the CCWD intake on Old River, and at Clifton Court Forebay. EC during these months with salinity increases would not exceed SWRCB Decision 1641 criteria. Therefore, the overall changes in salinity in the Delta under Alternative D would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in the Delta under Alternative D would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Suisun Bay and Suisun Marsh

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Salinity

Alternative D would result in changes in inflow patterns into Suisun Bay, Suisun Marsh, and San Francisco Bay as compared to the Existing Conditions/No Project/No Action Condition. Salinity in Suisun Bay would be reduced or similar in the summer and fall months at Collinsville near the confluence of the Sacramento and San Joaquin rivers, Mallard Slough, and Port Chicago under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling. However, salinity at Collinsville under Alternative D would increase from December through March in Above Normal water years, January and March in Below Normal water years, February through April in Dry water years, and January through March in Critical water years as compared to the Existing Conditions/No Project/No Action Condition. Similar changes in salinity occur in the winter months at Mallard Slough and Port Chicago, as shown in Appendix 7D Sacramento-San Joaquin Delta Modeling.

The X2 position in the western Delta and Suisun Bay would be similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling.

Mercury

As described in Section 7.2, the primary sources of mercury in Suisun Bay and Suisun Marsh are the tributaries of the Sacramento River and the Yolo Bypass. The generation rate and the accumulation rates of mercury in Suisun Bay and Suisun Marsh would be similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. The generation rate of methylmercury from the Yolo Bypass would be reduced or similar under Alternative D as compared to the Existing Conditions/ No Project/No Action Condition. Within Suisun Bay and Suisun Marsh, there would not be any change to the extent of wetlands where lands that may contain high levels of mercury would experience changes in the periods of inundation and drying. Therefore, the potential for methylmercury generation would not change in Suisun Bay and Suisun Marsh under Alternative D as compared to the Existing Conditions/ No Project/No Action Condition.

Nutrients, Dissolved Oxygen, and Total Organic Carbon

The sources of nutrients and total organic carbon concentrations in the Suisun Bay and Suisun Marsh would be similar under Alternative D and the Existing Conditions/No Project/No Action Condition Also, dissolved oxygen conditions related to nutrient and total organic carbon concentrations would be similar.

Dissolved oxygen concentrations are also affected by reductions in Suisun Bay and Suisun Marsh outflow in the warm summer and fall months. As described in Chapter 6 Surface Water Resources and Appendix 6B Water Resources System Modeling, Delta outflows would increase in the summer months and would be similar in the fall months under Alternative D as compared to the Existing Conditions/No Project/ No Action Condition. Therefore, dissolved oxygen concentrations would be higher or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Summary

Salinity in the summer and fall months would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. However, increased salinity would occur from December through April when Delta outflow declines as water is diverted into Sites Reservoir. The salinity would continue to be consistent with SWRCB Decision 1641 criteria during those months. Therefore, overall changes in salinity in Suisun Bay and Suisun Marsh under Alternative D would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

Mercury, nutrients, and total organic carbon generally would be reduced or similar under Alternative D as compared to the Existing Conditions/No Project/No Action Condition. Also, dissolved oxygen would be higher or similar. Therefore, the overall changes in mercury, nutrients, total organic carbon, and dissolved oxygen in Suisun Bay and Suisun Marsh under Alternative D would be **less than significant** as compared to the Existing Conditions/No Project/No Action Condition.

7.3.7.3 *Primary Study Area*

Construction, Operation, and Maintenance Impacts

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The construction, operations, and maintenance activities in the Primary Study Area under Alternative D would be the same as those described under Alternative A, except that Sites Reservoir would be larger.

Refer to **Impact SW Qual-1** discussion under Alternative A for construction, operations, and maintenance impacts under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

Under Alternative D, the potential for changes in salinity in Sites Reservoir related to potential seepage from the springs near Salt Lake (if the grout seal does not reduce seepage) would result in an increase in EC of less than 0.5 µmhos/cm (0.2 percent). The high salinity water from the Salt Lake area would represent less than 0.005 to 0.75 percent of the total water in Sites Reservoir under Alternative D.

Therefore, Alternative D would have the same potential for surface water quality changes as that described for Alternative A (**Impact SW Qual-1**) and would result in a **less-than-significant impact** under Alternative D as compared to the Existing Conditions/No Project/No Action Condition.

7.4 Mitigation Measures

Because no potentially significant direct water quality impacts were identified, no mitigation is required or recommended. Environmental commitments, including construction management procedures and stormwater pollution prevention, erosion control, and dewatering best management practices are included in all Project alternatives and discussed in Chapter 3 Description of the Sites Reservoir Project Alternatives and Chapter 28 Public Health and Environmental Hazards.

Potential changes to aquatic resources because of higher salinity in the Delta, Suisun Bay, and Suisun Marsh, and because of higher water temperatures in the Sacramento River under Alternatives A, B, C, and D as compared to conditions under the Existing Conditions/No Project/No Action Condition are addressed in Chapter 12 Aquatic Biological Resources.