Chapter 3

Description of Alternatives

3.1 Introduction

This chapter describes the methodology used for development of all potential alternatives and the basis for selecting the reasonable range of alternatives which are evaluated in detail in this Environmental Impact Statement (EIS).

3.2 Approach to Identify Potential Alternatives

This EIS evaluates a range of alternatives to the No Action Alternative for the coordinated long-term operation of the Central Valley Project (CVP) and the State Water Project (SWP) in the Year 2030. The No-Action Alternative includes full implementation of the 2008 USFWS Biological Opinion (2008 USFWS BO) and the 2009 National Marine Fisheries Service (NMFS) Biological Opinion (2009 NMFS BO) Reasonable and Prudent Alternatives (RPAs), in addition to other ongoing and future programs that would be reasonably foreseeable to be implemented by 2030.

Identification of the No Action Alternative and the range of alternatives for this EIS were developed to respond to the purpose and need for the action and comments received during the scoping process and preparation of the Draft EIS, as summarized below.

3.2.1 Scoping Process

The scoping process was initiated on March 28, 2012, with the publication of the Notice of Intent in the Federal Register and continued through June 28, 2012. Five scoping meetings were held to inform the public and interested stakeholders about the project, and to solicit comments and input on the EIS. The scoping meetings were held in Madera, Diamond Bar, Sacramento, Marysville, and Los Banos, California, in April and May 2012. Many scoping comments addressed the definition and range of alternatives, as summarized below and in the Scoping Report (included as Appendix 23A of this EIS).

- Alternative South Delta operation criteria, including:
  - Changes to Old and Middle River (OMR) flow criteria from what was described in the 2008 USFWS BO and 2009 NMFS BO
  - Changes to operational criteria of CVP and SWP south Delta intakes relative to the ratio of San Joaquin River inflows to south Delta exports;
  - Changes to measurement methods for OMR flow criteria related to locations of measurements and inclusion of Contra Costa Water District intakes within the calculations of OMR flows.

- Measures to benefit the survival and recovery of listed aquatic species that do not involve modifications of long-term operation of the CVP and SWP, such as improved water quality, reduction of populations of predators of listed aquatic species in the Delta, regulation of small unscreened water diversions, restoration of floodplain habitat, and provisions for levee vegetation approaches.
- Measures to improve primary productivity and food supply for salmonids and Delta Smelt (Delta Smelt and Longfin Smelt), including through increased spring outflow, reduced Delta diversions, and changes in Delta flow patterns resulting from channel modifications or changes in Delta exports that change Delta residence times for aquatic species.
- Measures to support Federal and State fish population doubling mandates and goals.
- Measures to increase opportunities for transfer of water through the Delta.
- Measures to increase water supply availability from the CVP and SWP south Delta intakes.
- Measures to reduce reliance on Delta water supplies by reducing water supply availability from the CVP and SWP south Delta intakes.
- Complete cessation of long-term operation of the CVP and SWP, including benefits related to the operation of the CVP and SWP reservoirs, such as flood management and recreational benefits.
- Measures to prioritize CVP operations of the Trinity, Sacramento, American, and Stanislaus rivers to meet in-watershed water demands, not only in accordance with existing water rights and agreements, but also for CVP water contractors specifically located within the American and Stanislaus river watersheds.
- Measures to prioritize use of Central Valley Project Improvement Act (CVPIA) restoration funds within geographic locations collected from CVP water users in those locations.

3.2.2 Concepts Identified during Preparation of the Draft EIS

As described in Chapter 23, Consultation and Coordination, status meetings were held throughout preparation of the Draft EIS with stakeholders and interested parties between 2012 and 2015. Following the scoping process, the discussions were initially focused on identification of the No Action Alternative, other bases of comparisons, and alternative concepts to the RPAs. Based upon these discussions, the development of alternatives process initially focused on identification of the No Action Alternative, and subsequently, upon development of the range of alternatives to the No Action Alternative.

3.3 Identification of the Bases of Comparison

Council on Environmental Quality (CEQ) regulations require an EIS to include evaluation of a No Action Alternative (40 CFR 1502.14). The No Action Alternative is defined as the projections of current conditions and trends into the future without implementation of alternatives. These projected conditions are defined by CEQ as "'no change' from current management direction or level of management intensity." The No Action Alternative also can be defined as "no project" in cases where a new project is proposed for implementation. However, all of the alternatives evaluated in this EIS are to continue the coordinated long-term operation of the CVP and SWP. Therefore, the definition of the No Action Alternative a continuation of the management direction and level of intensity used for this EIS.

For this EIS, the No Action Alternative is based upon the continued operation of the CVP and SWP in the same manner as occurred at the time of the publication of the Notice of Intent in March 2012. Thus, the No Action Alternative consists of the coordinated long-term operation of the CVP and SWP, including full implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO because Reclamation provisionally accepted the BOs in 2008 and 2009, respectively, and is implementing the RPAs. The No Action Alternative also includes changes not related to the long-term operation of the CVP and SWP or implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO, as described in subsequent sections of this chapter.

Numerous scoping comments requested that the No Action Alternative not include the RPAs in the 2008 USFWS BO and 2009 NMFS BO because, at that time, the District Court had remanded the biological opinions (BOs) back to USFWS and NMFS. The comments indicated that the EIS should include a "basis of comparison" for the alternatives that was similar to conditions prior to implementation of the RPAs. Scoping comments also indicated that a "No Action Alternative scenario" without implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO could be used to analyze the effects of implementing the RPAs.

Because the RPAs were provisionally accepted and the No Action Alternative, represents a continuation of existing policy and management direction, the No Action Alternative includes the RPAs. However, in response to scoping comments and subsequent comments from stakeholders and interest groups; and to provide a basis for comparison of the effects of implementation of the RPAs (per the District Court's mandate), this EIS includes a "Second Basis of Comparison" that represents a condition in 2030 without implementation of the 2008 USFWS BO and 2009 NMFS BO. All of the alternatives will be compared to the No Action Alternative and to the Second Basis of Comparison to describe the effects that could occur by 2030 under both bases of comparison.

Several of the 2009 NMFS BO RPA actions had been initiated prior to issuance of the 2009 NMFS BO; and therefore, those actions are included in the Second Basis of Comparison, as described below. Reasonably foreseeable actions included in the No Action Alternative that are not related to the 2008 USFWS BO or 2009 NMFS BO are also included in the Second Basis of Comparison.

3.3.1 Conditions in Year 2030 without Implementation of Alternatives 1 through 5

Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to environmental justice factors that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section, including:

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the State Water Resources Control Board (SWRCB); and operational requirements of the 2008 USFWS BO and the 2009 NMFS BO.
- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs.
- Implementation of existing and future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS.

3.3.1.1 Continued Long-Term Operation of the CVP and SWP Facilities

The CVP and SWP divert water from the Sacramento River and San Joaquin River watersheds, including from the southern portion of the Sacramento–San Joaquin River Delta (Delta) for use within the watersheds and within areas located to the south and west of the Delta. The CVP and SWP facilities store water during wet periods, divert water that is surplus to the Delta needs, and re-divert CVP and/or SWP water that has been stored in upstream reservoirs for downstream uses.

The CVP and SWP are operated by Reclamation and the California Department of Water Resources (DWR), respectively, pursuant to water right permits and licenses issued by the SWRCB, the requirements of the 2008 USFWS BO and the 2009 NMFS BO, and other applicable statutory and regulatory requirements. The SWRCB permits and licenses appropriate specific quantities of water for diversion to storage, releases from that storage later in the year, and/or direct diversion. As conditions of the water right permits and licenses, the CVP and SWP are required by SWRCB to meet specific water quality, quantity, and operational criteria. In accordance with 2008 USFWS BO and the 2009 NMFS BO, flow, temperature, salinity, and Delta export criteria are specified for the continued long-term operation of the CVP facilities and SWP Delta export facilities to avoid jeopardy to listed species and destruction or adverse modification of designated critical habitat.

Reclamation and DWR coordinate CVP and SWP operations to meet these conditions through the Coordinated Operation Agreement (COA), signed in 1986, that defines the project facilities and their water supplies, coordinates operational procedures, identifies formulas for sharing joint responsibilities for meeting Delta standards and other legal uses of water, identifies how unstored flow will be shared, establishes a framework for exchange of water and services between the CVP and SWP, and provides for periodic review of the agreement. Since 1986, facilities operations have been modified in response to regulatory requirements that were not part of the original COA assumptions or requirements. In addition, water quality and flow standards have been revised by the SWRCB since 1986, such as SWRCB Decision 1641 (D-1641) adopted in 2000. Reclamation and DWR have operational arrangements to accommodate new facilities, water quality and flow objectives, the CVPIA, SWRCB criteria, and Federal Endangered Species Act (ESA), but the COA has not been formally modified to address these operating conditions that have been implemented following adoption of COA.

The ongoing operational management policies of the CVP and SWP are anticipated to continue under the No Action Alternative and Second Basis of Comparison. These operational assumptions are described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations, and summarized in Chapter 5, Surface Water Resources and Water Supplies.

3.3.1.2 Actions included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Several actions included in the 2008 USFWS BO and 2009 NMFS BO address items are underway in 2008 and 2009, respectively. Some of the actions are ongoing and others have been completed. Ongoing or completed actions that would be, or have been, implemented with or without the BOs, including the following actions.

- 2008 USFWS BO RPA Component 4, Habitat Restoration. In 2014, Reclamation, California Department of Fish and Wildlife (CDFW), and USFWS adopted and initiated implementation of the Suisun Marsh Habitat Management, Preservation, and Restoration Plan (Suisun Marsh Management Plan). The No Action Alternative assumes that the Suisun Marsh Management Plan will provide up to 7,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh with or without implementation of the 2000 USFWS BO. This would represent up to 87 percent (7,000 of 8,000 acres of this habitat type referenced in the 2008 USFWS BO.

- 2009 NMFS BO RPA Action I.1.3, Clear Creek Spawning Gravel Augmentation. This effort was initiated in 1996 under the CVPIA Section 3406(b)(12), and is assumed to continue under the No Action Alternative and Second Basis of Comparison. The Clear Creek fisheries habitat restoration program is being implemented by USFWS and Reclamation in accordance with CVPIA (Reclamation 2011a). By the year 2020 the overall goal is to provide 347,288 square feet of usable spawning habitat from Whiskeytown Dam downstream to the former McCormick-Saeltzer Dam, which is the amount that existed before construction of Whiskeytown Dam. Between 1996 and 2009, a total of approximately 130,925 tons of spawning gravel was added to the creek. The interim annual spawning gravel addition target is 25,000 tons per year, but due to a lack of funding, only an average of 9,358 tons has been placed annually since 1996 (Reclamation 2013a). In 2010, the first annual evaluation of spawning gravel implementation and monitoring was submitted to NMFS as required by the NMFS BO. In 2012, Reclamation placed 10,000 tons of spawning gravel at four locations: Guardian Rock/Below N.E.E.D. Camp, Placer Bridge, Clear Creek Crossing/Bridge, and Tule Backwater.

- 2009 NMFS BO RPA Action I.1.4, Spring Creek Temperature Control Curtain Replacement. This action was completed when the temperature control curtain was replaced in 2011, as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations.
- 2009 NMFS BO RPA Action I.2.6, Restore Battle Creek for Winter-Run, Spring-Run, and Central Valley Steelhead. The Battle Creek Salmon and Steelhead Restoration Projects under construction to reestablish approximately 42 miles of salmon and steelhead habitat on Battle Creek and an additional 6 miles of habitat on tributaries. The Project is a collaborative effort between Reclamation, USFWS, NMFS, CDFW, Pacific Gas & Electric Company (PG&E), and other groups. Prior to 2030, elements of the project will be completed including removal of five dams, installation of new fish screens and fish ladders, provisions for increased instream flows in Battle Creek, improved access roads and trails, and decommissioned power plant canals that conveyed water between tributaries. The No Action Alternative assumes implementation of this project with or without implementation of the 2009 NMFS BO.
- 2009 NMFS BO RPA Action I.3.1, Operate Red Bluff Diversion Dam with Gates Out. This action was completed when the new Red Bluff Pumping Plant began operation in 2012, and the gates no longer block the flow of water in the Sacramento River, as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations.
- 2009 NMFS BO RPA Action I.5, Funding for CVPIA Anadromous Fish Screen Program. This effort was initiated over 20 years ago under the CVPIA Section 3406(b)(21), and is assumed to continue under the No Action Alternative with or without implementation of the 2009 NMFS BO. The No Action Alternative assumes continued implementation of the program to meet the program objectives by 2030.
- 2009 NMFS BO RPA Action I.6.1, Restoration of Floodplain Habitat; and Action I.6.2, Near-Term Actions at Liberty Island/Lower Cache Slough and Lower Yolo Bypass; Action I.6.3, Lower Putah Creek Enhancements; Action I.6.4, Improvements to Lisbon Weir; and Action I.7, Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass. These actions are addressed in the

ongoing Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Implementation Plan) that has been initiated by Reclamation and DWR. The No Action Alternative and Second Basis of Comparison assume completion of this Implementation Plan by 2030 with or without implementation of the 2009 NMFS BO. The Implementation Plan includes an operable gate at or near the Fremont Weir and modification of the Sacramento Weir to increase the frequency and extent of floodplain inundation in the Yolo Bypass; restoration of at least 20,000 acres of floodplain rearing habitat (excluding tidally-influenced areas); and habitat enhancements in the Yolo Bypass, including measures to avoid stranding or barriers to migration. The No Action Alternative and Second Basis of Comparison assume that an operable gate would be installed in or near the Fremont Weir that would allow for controlled flows from the Sacramento River into the Yolo Bypass when Sacramento River water elevations exceed approximately 17.5 feet (NAVD88). Other portions of Fremont Weir would continue to block flows into the Yolo Bypass until the Sacramento River water elevations exceed 32.8 feet (NAVD88).

- 2009 NMFS BO RPA Action II.1, Lower American River Flow Management. This effort was initiated in 2006 when Reclamation began operating in accordance with the American River Flow Management Standard (FMS), as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations. The No Action Alternative and Second Basis of Comparison assume continued operations under the FMS.

3.3.1.3 Future Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

The No Action Alternative and Second Basis of Comparison include assumptions unrelated to implementation of the 2008 USFWS BO and 2009 NMFS BO, including: climate change and sea level rise; development of lands in accordance with general plans in areas served by CVP and SWP water supplies; and reasonable and foreseeable projects that have been approved and are anticipated to be implemented by 2030.

3.3.1.3.1 Climate Change and Sea Level Rise

Under Section 9503 of the SECURE Water Act (Public Law 111-11, Subtitle F), Reclamation conducted a comprehensive assessment of current information on potential future climate change impacts and implications for long-term water management in the West, as described in Appendix 5A, Modeling Methodology. Projections of future climate in the Sacramento and San Joaquin River basins are summarized, with regard to temperature, precipitation, snowpack, and runoff. Results indicate that temperatures across both river basins may increase steadily, with the basin-average mean annual temperature projected to increase by roughly 5^{o} to 6^{o} Fahrenheit (F) during the 21st century. Annual precipitation in the basins should remain geographically variable over the next century, with current projections suggesting that annual basin-wide precipitation may initially stay steady to slightly increasing, to an eventual slight decrease over the region. With regard to snowpack, increased warming is expected to diminish snow accumulation during the cool season and reduce the availability of snowmelt to sustain runoff during the warm season. Reductions in annual runoff are predicted to occur by the latter half of the century. Changes in runoff seasonality are generally projected, with warming leading to more rainfall and runoff in the cool season and less runoff during the spring, affecting seasonal water supplies. One difficulty that arises in taking climate change into account in long-term water resources planning is that the natural variability is often greater than the magnitude of change expected over several decades.

Global and regional sea levels have been increasing steadily over the past century and are expected to continue to increase throughout this century (BCDC 2011). The National Research Council recently released a study of sea level rise on the west coast. Key results indicate that global sea level has risen about 7 inches in the 20th century and the rate of sea level rise is accelerating (NRC 2012). Relative to year 2000 levels, global sea level is projected to rise 3 to 9 inches by 2030, 7 to 19 inches by 2050, and 20 to 55 inches by 2100. Sea level rise along the California coast south of Cape Mendocino are projected to show even greater ranges of potential change. As a result, sea level rise associated with climate change will continue to threaten coastal lands and infrastructure, increase flooding at the mouths of rivers, place additional stress on levees and water resources in the Delta.

3.3.1.3.2 Continued Implementation of Ongoing Federal, State, and Local Water Resources Policies

The No Action Alternative and Second Basis of Comparison assume continued implementation of ongoing water resources policies and programs that are not addressed in the 2008 USFWS BO and 2009 NMFS BO, including the following programs.

- Federal Clean Water Act, including completion of Total Maximum Daily Load programs, National Pollutant Discharge Elimination System permits, and Waste Discharge Permits, as described in Chapter 6, Surface Water Quality.
- SWRCB water rights and water quality policies and programs, as described in Chapter 5, Surface Water Resources and Water Supplies.
- Federal Safe Drinking Water Act and California Safe Drinking Water Act policies and programs related to drinking water treatment requirements, as described in Chapter 6, Surface Water Quality.
- Federal Clean Air Act and California Clean Air Act, including completion of the compliance programs in accordance with the State Implementation Plans, as described in Chapter 16, Air Quality and Greenhouse Gas Emissions.
- Flood management policies and programs established by the U.S. Army Corps of Engineers (USACE), Federal Emergency Management Agency, DWR,

Central Valley Flood Protection Board, and local flood management agencies, as described in Chapter 5, Surface Water Resources and Water Supplies.

3.3.1.3.3 General Plan Development in CVP and SWP Service Areas

Counties and cities throughout California have adopted general plans which identify land use classifications including those for municipal and industrial uses and those for agricultural uses. Preparation of general plans includes an environmental evaluation under the California Environmental Quality Act to identify adverse impacts to the physical environment and to provide mitigation measures to reduce those impacts to a level of less than significance. Most of the counties where CVP and SWP water supplies are delivered have adopted general plans following the environmental review of the plans and appropriate alternatives. Population projections from those general plan evaluations are provided to the State Department of Finance and are used to project future water needs and the potential for conversion of existing undeveloped lands and agricultural lands. Many of the existing general plans for counties with municipal areas recently have been modified to include land use and population projections through 2030. The No Action Alternative and Second Basis of Comparison assume that land uses, as described in Chapter 13, Land Use, will develop through 2030 in accordance with existing general plans.

3.3.1.3.4 Other Reasonable and Foreseeable Projects and Programs

The No Action Alternative and Second Basis of Comparison assume continued implementation of existing projects and facilities, including water supply and wastewater management facilities, flood management facilities, and recreational facilities. In addition, the No Action Alternative assumes implementation of the following ongoing projects by 2030. These project descriptions are organized geographically from north to south in the State of California.

Trinity River Restoration Program

The Trinity River Restoration Program is a conducted by eight partners that form the Trinity Management Council, including Reclamation, USFWS, NMFS, U.S. Forest Service, Hoopa Valley Tribe, Yurok Tribe, California Resources Agency, and Trinity County. The Trinity River Flow Evaluation Final Report was adopted in 1999 and the Trinity River Record of Decision (ROD) was signed in 2000 to implement restoration of the physical processes and rehabilitate the Trinity River as foundation for fisheries recovery. The ROD described four restoration methods (flow management through releases from Lewiston Dam, construction of channel rehabilitation sites, augmentation of gravels, and control of fine sediments); infrastructure improvements to accommodate high flow releases from Lewiston Dam; environmental compliance with improvements to riparian vegetation and wetlands, reduced turbidity, and improved water temperatures; and science-based adaptive management. The Trinity River Restoration Program 2011 Annual Report indicated that about half of the projects described in the Flow Evaluation Study had been completed and intensive assessments of the physical responses of the Trinity River and geomorphic assessments of the 40-mile restoration reach had been initiated (TRRP 2012). This project will improve conditions for aquatic species in the Trinity River.

Continued Implementation of the Central Valley Project Improvement Act Provisions

In 1992, the CVPIA (Title 34 of Public Law 102-575) was adopted to include fish and wildlife protection, restoration, enhancement, and mitigation as purposes of the CVP having equal priority with irrigation and domestic water supply uses, and power generation. The purpose of the CVPIA is expressed in six broad statements found in Section 3402 of the Act:

- To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California;
- To address impacts of the CVP on fish, wildlife, and associated habitats;
- To improve the CVP's operational flexibility;
- To increase water-related benefits provided by the CVP to the state through expanded use of voluntary water transfers and improved water conservation;
- To contribute to the state's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary;
- To achieve a reasonable balance among competing demands for use of CVP water, including the requirements of fish and wildlife, agricultural, municipal and industrial, and power contractors.

The Secretary of the Department of the Interior (DOI) assigned primary responsibility for implementing CVPIA's many provisions to Reclamation and USFWS. Reclamation and USFWS coordinate with other federal agencies, tribes, the State of California, and numerous partners and stakeholders during each fiscal year to plan and implement activities.

The current focus of the CVPIA Program is on fish and wildlife restoration, water management, and conservation activities, authorized in Sections 3406 and 3408 of the Act. These goals fit within four broad resource areas: Fisheries, Water Operations, Refuges and Other Resources (Reclamation 2013c).

The Fisheries Resource Area includes actions to implement the CVPIA "fish-doubling goal" for Chinook Salmon, Rainbow Trout (steelhead), Striped Bass, American Shad, White Sturgeon and Green Sturgeon. The 2001 Final Restoration Plan to implement the CVPIA included 289 actions and evaluations that were determined to be reasonable given numerous technical, legal and implementation considerations. Reclamation and USFWS are implementing these and related actions (Reclamation 2013c). In 2008, the CVPIA Program conducted an independent review of the status of actions to achieve the fish-doubling goal. Following the review, a revised plan was developed to emphasize managing all of the fisheries programs as one program instead of individual actions; utilize a science-based management framework to address problems at a system level; report accomplishments by watershed; and improve transparency by communicating the coordination and decision-making that occurs within the program. The No Action Alternative assumes that the CVPIA Program will continue to be implemented in 2030.

The Water Operations Resource Area includes provisions to supply CVP water to resource locations in flow, quantity, velocity, and timing patterns that would contribute to the biological resources in accordance with Section 3406(b) of CVPIA (Reclamation 2013c). The No Action Alternative assumes that water operations will continue to include measures identified in Section 3406(b).

The Refuges Resources Area includes actions to contribute to the maintenance, restoration and enhancements of wetlands and waterfowl habitat either directly or through contractual agreements with other appropriate parties, firm water supplies of suitable quality to maintain and improve wetland habitat areas on 19 federal, state and private lands. The CVPIA requires Reclamation to provide CVP water to meet "Level 2" water demands and to obtain water supplies to meet "Level 4" water demands (Reclamation 2013c). In 2009, the CVPIA Program conducted an independent review of the refuge water supply program. The report indicated that Level 2 water supplies had become more reliable under CVPIA; however, Level 4 water supplies were not fully obtained. In response, Reclamation entered into an agreement with USFWS and the National Fish and Wildlife Foundation to explore avenues to improve the effectiveness of the water acquisitions, including those for Incremental Level 4; assessed ways to increase the priority for pumping, conveyance and storage of Incremental Level 4 water supplies in CVP facilities; and continued planning for external storage and conveyance facilities to meet refuge water supply needs. The No Action Alternative assumes that refuge water supplies will continue to be provided in 2030.

The Other Resource Area actions are related to terrestrial habitat and species; and water quality and conservation. One of the programs implemented in this resource area includes the Section 3406(b)(1) "other" Habitat Restoration Program, which focuses on protecting native habitats that have been directly and indirectly affected by the CVP's construction and operation (Reclamation 2013c). This is accomplished through the purchase of fee title or conservation easements on lands where threats are significant and restoring lands to native habitat. Another program is the Land Retirement Program, Section 3408 (h), to purchase and retire land from agricultural production to improve water quality and provide for terrestrial habitat restoration. The No Action Alternative assumes that these actions will continue in a manner similar to ongoing operations.

DOI is continuing to implement CVPIA using an improved science-based decision making process using a scientific framework that connects restoration actions to environmental and population responses across watersheds (Reclamation 2013c). A system-wide science-based approach with performance indices, monitoring, and scientific review of results is used to provide direction as the CVPIA adapts to changing conditions.

Clear Creek Mercury Abatement and Fisheries Restoration Project

The Lower Clear Creek Aquatic Habitat and Waste Discharge Improvement Project was initiated to remove the long-term impacts of mercury contamination in Lower Clear Creek and to create over 5 acres of new wetlands. The mercury sources are dredge-mined tailings from more than 200 historic gold and gravel mines in the watershed. The tailings are located on the properties adjacent to Clear Creek and in gravels historically used for spawning gravel supplementation. This is being completed in accordance with CVPIA actions (WSRCD 2011). This project will improve conditions for aquatic species in Clear Creek and the upper Sacramento River.

Iron Mountain Mine Superfund Site

The Iron Mountain Mine Superfund Site on Spring Creek had discharged acid mine drainage into several creeks that are tributary to Keswick Reservoir and the Sacramento River since the late 1890s. The interim remedies include source control, acid mine drainage collection and treatment, and water management, including water diversions and coordinated releases of contaminated surface water from Spring Creek Debris Dam with dilution flows released from the Spring Creek power plant and Shasta Lake. In 2008, the U.S. Environmental Protection Agency indicated that the interim remedies were operational and had reduced metal loading discharges by 95 percent as compared to pre-project conditions. A final restoration plan for natural resources injured by Iron Mountain Mine operation was adopted in 2002 by USFWS, CDFW, National Oceanic and Atmospheric Administration, Bureau of Land Management, and Reclamation and those programs are being implemented (USEPA 2008). This project will improve water quality and conditions for aquatic species in Spring Creek and the upper Sacramento River.

Mainstem Sacramento River, American River, and Stanislaus River Gravel Augmentation Programs

The Mainstem Sacramento Gravel Augmentation Program is an ongoing Reclamation project that helps meet requirements of Section 3406 (b)(13) of the CVPIA to restore and replenish spawning gravel and rearing habitat for salmonid species. Reclamation began placing salmonid spawning gravel in the Sacramento River approximately 0.25 miles downstream of Keswick Dam in 1997 and subsequently in Salt Creek. The project will place approximately 5,000 tons of gravel into the river and implement riffle supplementation/side-channel excavation to help improve spawning habitat for Chinook Salmon and steelhead (Reclamation and USFWS 2012). This project will improve conditions for aquatic species in the upper Sacramento River.

The Lower American River Salmonid Spawning Gravel Augmentation and Side-Channel Habitat Establishment Program to increase and improve salmon and steelhead spawning and rearing habitat by replenishing spawning gravel and establishing additional side-channel habitat at new restoration sites along the lower American River between Nimbus Dam and Upper Sunrise Recreation Area and at Arden Rapids. Gravel augmentation, side channel excavation, and incorporation of woody material into the main channel to improve Chinook Salmon and steelhead spawning and rearing habitat (Reclamation 2008, 2014e).

Gravel restoration also has been implemented on the lower Stanislaus River since 2004 (Reclamation 2011c).

Nimbus Fish Hatchery Fish Passage Project

A fish passageway from the Nimbus Fish Hatchery to the stilling basin downstream of the Nimbus Dam will be constructed and the diversion weir will be removed. This project will create and maintain a reliable system for collecting adult fish to allow Reclamation to mitigate for loss of access to spawning areas following construction of Nimbus Dam and adequately protect Chinook Salmon and Central Valley steelhead. The project is scheduled to start in 2018 if adequate funding is appropriated. This project will improve conditions for aquatic species in the lower American River and lower Sacramento River.

Folsom Dam Water Control Manual Update

The USACE is developing and evaluating alternatives to change flood management operations of Folsom Dam and Folsom Lake to reduce flood risk to the Sacramento area. Currently, the USACE is completing construction of the new auxiliary spillway at Folsom Dam and is completing an in-depth analysis of recent hydrologic data for the American River watershed upstream of Folsom Dam. The study will result in an updated Water Control Manual following completion of an EIS and an engineering report (USACE et al. 2012). This project could change flow patterns in the American and Sacramento rivers and the Delta.

Federal Energy Regulatory Commission Relicensing for Middle Fork of the American River Project

The Federal Energy Regulatory Commission (FERC) completed a final EIS for the relicensing of the Placer County Water Agency existing 223,753 kilowatt Middle Fork American River Hydroelectric Project. The project is located on the Middle Fork of the American River, Rubicon River, and Duncan and North and South Fork Long Canyon creeks in Placer and El Dorado counties. The re-licensing will provide for continued operation of the project with increased pulse and minimum instream flow releases, defined ramping rates, whitewater boating flow releases, protection of sensitive species, maintenance and enhancement of recreation opportunities, erosion and sedimentation reduction measures, vegetation improvement plans, and recreation management plans (FERC 2012). This project will change flow patterns in the American River and improve conditions for aquatic species in portions of the American River watershed.

Lower Mokelumne River Spawning Habitat Improvement Project

The Mokelumne River is tributary to the Delta and supports five species of anadromous fish. The proposed project will initially include placement of 4,000 to 5,000 cubic yards of suitably sized salmonid spawning gravel annually for a 3-year period at two specific sites, and then provide annual supplementation of 600 to 1,000 cubic yards thereafter. Fall-run Chinook Salmon and steelhead are the primary management focus in the river. Availability of spawning gravel in this section of the Mokelumne River has been determined to be deficient because historic gold and aggregate mining operations removed gravel annually and upstream dams have reduced gravel transport to the area. This area was chosen because it is known to have supported fall-run Chinook Salmon and steelhead spawning in the past and because the substrate is suitable for habitat improvement (USFWS 2009).

This project will improve conditions for aquatic species in the Mokelumne and San Joaquin rivers.

Dutch Slough Tidal Marsh Restoration

The Dutch Slough Tidal Marsh Restoration Project, located near Oakley in Eastern Contra Costa County, will restore wetland and uplands, and provide public access to the 1,200-acre Dutch Slough property. The property is composed of three parcels separated by narrow man-made sloughs. The project is a cooperative partnership between DWR, State Coastal Conservancy, CDFW, City of Oakley, Ironhouse Sanitary District, Reclamation Districts 2137 and 799, Natural Heritage Institute, and landowners. The project will provide ecosystem benefits, including habitat for sensitive species, including winter-run Chinook Salmon Sacramento splittail, and many waterfowl species. It also will be designed and implemented to maximize opportunities to assess the development of those habitats and measure ecosystem responses so that future Delta restoration projects will be more successful. DWR approved the Final Environmental Impact Report (EIR) for the project in March 2010 (NMFS 2013). This project will improve conditions for aquatic and terrestrial species in the Delta through tidal marsh restoration.

Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation

On March 2, 1987, the Suisun Marsh Preservation Agreement (SMPA) was signed by DWR, CDFW, Reclamation, and the Suisun Resource Conservation District. The purpose of the agreement was to establish mitigation for impacts on salinity from the SWP, CVP, and other upstream diversions. The SMPA contains provisions for Reclamation and DWR to mitigate the adverse effects on Suisun Marsh channel water salinity from operation of the CVP and SWP and other upstream diversions. The Suisun Marsh Habitat Management, Preservation and Restoration Plan (SMP) was completed in 2014 under the direction of Reclamation, USFWS, CDFW, NMFS, Suisun Resource Conservation District, and CALFED Bay-Delta Program (the Principal Agencies). This group was assisted by regulatory agencies such as the USACE, Bay Conservation and Development Commission, SWRCB, and the San Francisco Bay Regional Water Quality Control Board. The following actions will be implemented under the plan (Reclamation 2014a).

- Restoration of up to 7,000 acres of tidal marsh and protection and enhancement of up to 46,000 acres of managed wetlands through dredging, erosion protection, and installation of fish screens.
- Increased frequency of currently implemented managed wetlands activities.

- Implementation of the Preservation Agreement Implementation Fund (PAI Fund) to improve managed wetland flood and drain capabilities to accommodate high salinity water while maintaining functions and values of managed wetland habitats.

The plan includes environmental commitments and mitigation measures, an adaptive management program, and reporting through annual reports over the 30-year time frame of the plan. This project will improve conditions for aquatic and terrestrial species in the Delta and Suisun Marsh.

Tidal Wetland Restoration in the Delta and Suisun Marsh

In addition to tidal wetlands restoration that would occur in the Suisun Marsh, several programs are being implemented in the Cache Slough portion of the Delta. The 2008 USFWS BO RPA required a program to create or restore a minimum of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh. As described above, up to 7,000 acres of tidal marsh restoration would occur under the SMP. Other programs have been initiated to restore or expand tidal wetlands, and could provide an additional 3,000 acres of tidal wetlands in the Delta and Suisun Marsh. This additional 3,000 acres could be completed in accordance with the 2008 USFWS BO requirements. The No Action Alternative includes the following restoration programs.

- Yolo Ranch (initial phase), Northwest Field Network 4, and Flyway Farms – 941 and 405 acres, respectively, of tidal influenced lands (SFWCA 2011, 2013).
- Northern Liberty Island Fish Restoration Project – 737 acres (RD 2093 2011).
- Prospect Island Restoration Project – 1,170 acres (based on maps included in CDFW and DWR 2013).
- Calhoun Cut/Lindsey Slough Tidal Habitat Restoration Project – 87 acres (CDFW 2015).

San Joaquin River Restoration Program

The San Joaquin River Restoration Program is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook Salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows. The restoration program is the product of more than 18 years of litigation, which culminated in a Stipulation of Settlement on the lawsuit known as *NRDC, et al., v. Kirk Rodgers, et al*. The settling parties reached agreement on the terms and conditions of the settlement, which was subsequently approved by the District Court on October 23, 2006. The settling parties include the Natural Resources Defense Council, Friant Water Users Authority, and the U.S. Departments of the Interior and of Commerce. The settlement's two primary goals are to:

- Restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced

River, including naturally reproducing and self-sustaining populations of salmon and other fish, and

- Reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the settlement.

The settlement requires specific releases of water from Friant Dam to the confluence of the Merced River, which are designed primarily to meet the various life stage needs for spring- and fall-run Chinook Salmon. The release schedule assumes continuation of the current average Friant Dam release of 116,741 acre-feet, annually, with specific flow requirements depending on the year type. The project was authorized and funded with the passage of San Joaquin River Restoration Settlement Act, part of the Omnibus Public Land Management Act of 2009 (Public Law 111-11). Interim flows began in October, 2009. There are many physical improvements within and near the San Joaquin River that will be undertaken to fully achieve the river restoration goal. The improvements will occur in two separate phases that will focus on a combination of water releases from Friant Dam, as well as structural and channel improvements (Reclamation 2012). This project will improve conditions for aquatic and terrestrial species in the San Joaquin River and the Delta.

This EIS does not address the CVP facilities associated with Millerton Lake, including the Madera and Friant-Kern canals and their service areas, and the San Joaquin River Restoration Program because these facilities are not considered in the consultations related to the 2008 USFWS BO and 2009 NMFS BO.

Stockton Deep Water Ship Channel Demonstration Dissolved Oxygen Project

The Stockton Deep Water Ship Channel Demonstration Dissolved Oxygen Project is a multiple-year study of the effectiveness of elevating dissolved oxygen (DO) concentrations in the channel. The DO concentrations drop as low as 2 to 3 milligrams per liter (mg/L) during warmer and lower water flow periods in the San Joaquin River. The low DO levels can adversely affect aquatic life including the health and migration behavior of anadromous fish (e.g., salmon). The objective of the study is to maintain DO levels above the minimum recommended levels specified in the 2006 Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River basins, as described in Chapter 6, Surface Water Quality.

The project’s full-scale aeration system includes two 200-foot-deep u-tube aeration tubes; two vertical turbine pumps capable of pumping over 11,000 gallons of water each; a liquid-to-gas oxygen supply system; and numerous pieces of ancillary equipment and control systems. The system has been sized to deliver approximately 10,000 pounds of oxygen per day into the Deep Water Ship Channel. The aeration system is anticipated to be operated only when channel DO levels are below the Basin Plan DO water quality objectives (approximately 100 days per year). The project study includes an on-going assessment of DO levels in the channel and vicinity and a study of potential adverse effects of low

DO on salmon (DWR 2010a). This project will improve water quality in the central and south Delta as compared to historical conditions.

Grasslands Bypass Project

The purposes and objectives of the Grasslands Bypass Project, 2010–2019, are to: 1) extend the San Luis Drain Use Agreement in order to allow the Grassland Basin Drainers time to acquire funds and develop feasible drainwater treatment technology to meet revised Basin Plan objectives and Waste Discharge Requirements by December 31, 2019; 2) continue the separation of unusable agricultural drainage water discharged from the Grassland Drainage Area from wetland water supply conveyance channels for the period 2010–2019; and 3) facilitate drainage management that maintains the viability of agriculture in the project area and promotes continuous improvement in water quality in the San Joaquin River. All discharges of drainage water from the Grassland Drainage Area into wetlands and refuges have been eliminated. The selenium load discharged from the Grassland Drainage Area has been reduced by 61 percent (from 9,600 pounds to 3,700pounds) and the salt load has been reduced by 39 percent (from 187,300 tons to 113,600 tons). Prior to the project, the monthly mean concentration of selenium in Salt Slough was 16 parts per billion. Since implementation of this project, the concentration has been less than the water quality objective of 2 parts per billion. The drainage water is conveyed to Mud Slough. Grasslands Water District and others are currently evaluating alternative plans to comply with Central Valley Regional Water Quality Control Board water quality objectives for selenium and salinity in the San Joaquin River at the end of this project in 2019. One of the alternatives could be zero discharge with complete recycle of the drainwater to salinity-tolerant crops (Reclamation 2009). This project will improve water quality in the San Joaquin River and the central and south Delta.

Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS)

In 2006, the Central Valley Regional Water Quality Control Board, the SWRCB, and stakeholders began a joint effort to address salinity and nitrate problems in California's Central Valley and adopt long-term solutions that will lead to enhanced water quality and economic sustainability. This effort is referred to as the Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) Initiative. The goal of CV-SALTS is to develop a comprehensive region-wide Salt and Nitrate Management Plan (SNMP) describing a water quality protection strategy that will be implemented through a mix of voluntary and regulatory efforts. The SNMP may include recommendations for numeric water quality objectives, beneficial use designation refinements, and/or other refinements, enhancements, or basin plan revisions.

The SNMP and will serve as the basis for amendments to the three Basin Plans that cover the Central Valley Region (Sacramento River and San Joaquin River Basin Plan, the Tulare Lake Basin Plan and the Sacramento/San Joaquin Rivers Bay-Delta Plan). The basin plan "amendments" will likely establish a comprehensive implementation plan to achieve water quality objectives for salinity (including nitrate) in the Region's surface waters and groundwater. The

SNMP may include recommendations for numeric water quality objectives, beneficial use designation refinements, and/or other refinements, enhancements, or basin plan revisions (CVRWQCB 2015). This project could change water quality and flow patterns in the San Joaquin River.

Municipal Water Supply Projects

Municipal water users in California are required to prepare Urban Water Management Plans (UWMPs) in accordance with the California Urban Water Management Planning Act of 1983. The State Water Conservation Act of 2009 (also known as SBx7-7) required the UWMPs to identify the water demands and water supplies for their service area through the year 2030, and to provide a plan to reduce statewide per capita water use by 20 percent by the year 2020. All of the UWMPs identify conservation measures to reduce water demands by 2020. Many of the UWMPs identify projects that are being planned or implemented to meet water demands in 2030. Water resources projects that have been approved and are being implemented are assumed to be complete by 2030 under the No Action Alternative. There are over 50 projects considered in the study area to be included in the No Action Alternative, including the following major water supply projects.

- Cambria Emergency Water Supply Project desalination project (CCSD 2014).
- Carlsbad Metropolitan Water District water recycling project (Carlsbad MWD 2012)
- Central Basin Municipal Water District Southeast Water Reliability Project (CBMWD 2011).
- City of Los Angeles Department of Water and Power groundwater recharge projects (City of Los Angeles 2011, 2013a).
- City of Oxnard GREAT Program Desalter (City of Oxnard 2013).
- Eastern Municipal Water District water recycling programs (EMWD 2014a, 2014b).
- Fresno Irrigation District groundwater recharge projects (FID 2015).
- Inland Empire Utilities Agency groundwater recharge projects (IEUA 2015).
- Kern County and Antelope Valley-East Kern Water Agency (AVEK 2011).
- Los Angeles County Sanitation Districts expansion of water recycling programs (LACSD 2005).
- San Benito County Water District expansion of water treatment plant to treat CVP water (SBCWD 2014).
- San Diego County Water Authority Carlsbad Seawater Desalination Facility (SDCWA 2014).
- Santa Barbara desalination water treatment plant (KEYT 2015).

- Santa Clara Valley Water District wastewater recycling projects (SCVWD 2012).
- Victor Valley Wastewater Reclamation Authority water recycling programs (VVWRA 2015).
- Water Replenishment District Groundwater Reliability Improvement Program and water recycling programs (WRD 2012, 2015).
- West Basin Municipal Water District recycling water programs (WBMWD 2011).
- Western Development and Storage Antelope Valley Water Bank (Reclamation 2010).
- Western Municipal Water District Arlington Desalter Expansion to use saline groundwater (WMD 2015).
- Woodland-Davis Clean Water Agency water treatment plant (WDCWA 2013).

Water Transfer Projects

Water transfer programs have been used historically throughout California, especially among CVP water users to meet both irrigation and municipal water demands either during drought or to replenish stored surface water or groundwater during wet periods (Reclamation 2013b).

Implementation of CVPIA in 1992 facilitated water transfers between CVP water users and between CVP water users and non-CVP water users. The water can be transferred through CVP facilities in a manner that does not harm the operation of the CVP for other users and beneficial uses. CVP facilities also can be used to convey non-CVP water under the Warren Act of 1911. In the first 10 years following adoption of CVPIA, more than 4.3 million acre-feet of water was transferred for agricultural and municipal water uses and more than 396,000 acre-feet was transferred to the DOI for Level 4 Refuge Water Supplies (Reclamation 2004). Water transfers also occur between the SWP water users and non-SWP water users. SWP facilities can be used to convey the transferred water, including non-SWP water, under DWR conveyance agreements.

Historically, water transfers primarily were in-basin transfers (e.g., Sacramento Valley water seller to Sacramento Valley water user) (Reclamation 2013b; DWR, Reclamation, USFWS and NMFS 2013). However, between 2001 and 2012, water transfers from the Sacramento Valley to the areas located south of the Delta of up to 298,806 acre-feet occurred (not including water transfers under the Environmental Water Account Program in the early 2000s) (DWR, Reclamation, USFWS and NMFS 2013). These transfers occurred in drier years. In 2012 and 2013, the following types of water transfers occurred (DWR and SWRCB 2014).

- Water transfers involving CVP and SWP water:
  - 2012: 47,420 acre-feet of water transfers (43 percent were between agricultural water users, 36 percent were between municipal water users, and 21 percent were between agricultural and municipal water users).
  - 2013: 63,790 acre-feet of water transfers (28 percent were between agricultural water users, and 72 percent were between agricultural and municipal water users).
- Water transfers involving non-CVP and SWP water:
  - 2012: 188,074 acre-feet of water transfers (72 percent were between agricultural water users, 14 percent were from agricultural water users to wildlife refuges, and 14 percent were between agricultural and municipal water users).
  - 2013: 268,370 acre-feet of water transfers (72 percent were between agricultural water users, 1 percent were from agricultural water users to wildlife refuges, and 27 percent were between agricultural and municipal water users).

Until recently, most of the water transfers extended for one or two years. In 2008, one of the first long-term water transfer agreements was approved by the SWRCB for the Lower Yuba River Accord. The plan was designed to protect and enhance fisheries resources in the Lower Yuba River, increase local water supply reliability, provide DWR with increased operational flexibility for protection of Delta fisheries resources, and provide added dry-year water supplies to CVP and SWP water users, as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations. In 2013, Reclamation approved an overall program for a 25-year period (2014 to 2038) to transfer up to 150,000 acre-feet/year of water from the San Joaquin River Exchange Contractors Water Authority to DOI for refuge water supplies or CVP and SWP water users (Reclamation 2013b). Reclamation is currently evaluating a long-term water transfer program (2015 to 2024) between water sellers in the Sacramento Valley and water users located in the San Francisco Bay Area and south of the Delta (Reclamation 2014b).

Transfer programs generally involve annual crop changes using temporary crop idling or shifting, release of stored water in reservoirs on different patterns for the purchasers' water demands, and/or groundwater substitution (DWR and Reclamation 2014). The transfers must be approved by the CVP and/or SWP if the transfer involves CVP or SWP water or utilizes CVP or SWP facilities. Except for water transfers among CVP water users, water transfers also require approval from the SWRCB. Environmental documentation is required for all water transfers involving CVP and/or SWP water supplies or facilities. Under State law, water transfers cannot result in injury to other legal users of water; unreasonable impacts on fish and wildlife and instream uses; and unreasonable economic or environmental impact on the county in which the transfer water originates.

It is assumed that transfers would continue under the No Action Alternative in a similar manner as have occurred for the past 10 years. It is anticipated that the number of long-term transfer agreements could increase to facilitate annual decisions for water transfers. However, the conditions for each water transfer would be determined on a case-by-case basis.

3.3.2 No Action Alternative

In addition to the common conditions described above, the No Action Alternative also would include existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would not occur by 2030 without implementation of the BOs. The actions related to the CVP and SWP operations are described in more detail in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations.

In addition to the operational actions, there are several actions that would not have been implemented by 2030 under the No Action Alternative without implementation of the 2008 USFWS BO and 2009 NMFS BO. These actions have not been fully defined at this time; and therefore, would require future engineering and environmental evaluation prior to implementation. These following actions are assumed to be completed under the No Action Alternative, and the objectives outlined in the 2008 USFWS BO and 2009 NMFS BO are assumed to be achieved by 2030.

- 2009 NMFS BO RPA Action I.2.5, Winter-Run Passage and Re-Introduction Program at Shasta Dam.
- 2009 NMFS BO RPA Action II.3, Structural Improvements for Temperature Management on the American River, including installation of a Folsom Dam temperature control device, methods to transport cold water through Lake Natoma, installation of a temperature control device on the El Dorado Irrigation District intake from Folsom Lake, and development of temperature management decision-support tools.
- 2009 NMFS BO RPA Action II.5, Fish Passage at Nimbus and Folsom Dams.
- 2009 NMFS BO RPA Action II.6, Implement Actions to Reduce Genetic Effects of Nimbus and Trinity River Fish Hatchery Operations.
- 2009 NMFS BO RPA Action III.2.1, Increase and Improve Quality of Spawning Habitat with Addition of 50,000 Cubic Yards of Gravel by 2014 and with a Minimum Addition of 8,000 Cubic Yards per Year for the Duration of the Project Actions on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.2, Conduct Floodplain Restoration and Inundation Flows in Winter or Spring to Inundate Steelhead Juvenile Rearing Habitat on One- to Three-Year Schedule on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.3, Restore Freshwater Migratory Habitat for Juvenile Steelhead by Implementing Projects to Increase Floodplain Connectivity and to Reduce Predation Risk During Migration on Stanislaus River.

- 2009 NMFS BO RPA Action III.2.4, Fish Passage at New Melones, Tulloch, and Goodwin Dams.
- 2009 NMFS BO RPA Action IV.4, Tracy Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.2 Skinner Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.3 Tracy Fish Collection Facility and the Skinner Fish Collection Facility Actions to Improve Salvage Monitoring, Reporting and Release Survival Rates.

3.3.3 Second Basis of Comparison

Numerous comments received during the scoping process and subsequently during preparation of the Draft EIS requested that the No Action Alternative not include the 2008 USFWS BO RPA and 2009 NMFS BO RPA. The comments indicated that the EIS should include a "basis of comparison" for the alternatives that was similar to conditions prior to implementation of the RPAs. Scoping comments also indicated that a "No Action Alternative scenario" without implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO could be used to analyze the effects of implementing the RPAs.

Reclamation has provisionally accepted and implemented the 2008 USFWS BO and 2009 NMFS BO actions, the No Action Alternative, by definition, must include these actions because they represent a continuation of existing policy and management actions. In response to the comments and to provide a basis for comparison of the effects of implementation of the RPAs (per the District Court's mandate), this EIS includes a "Second Basis of Comparison" that does not include implementation of the RPAs. The Second Basis of Comparison can be used as a basis of comparison for the alternatives that do not include the RPAs. In this way, the action alternatives can be compared against both the No Action Alternative and the Second Basis of Comparison.

The ongoing operational management policies of the CVP and SWP under the Second Basis of Comparison would be similar to the operational assumptions described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations, except for the sections identified as "Implementation of the 2008 USFWS BO [and/or 2009 NMFS BO]" and New Melones Reservoir operations.

Under Second Basis of Comparison, operations of New Melones Reservoir would be the same as under the No Action Alternative for flood management, water quality, San Joaquin River base flows and pulse flows at Vernalis, and water supply. Because the Second Basis of Comparison represents regulatory environment without the 2008 USFWS and 2009 NMFS BOs, fishery flows would be consistent with the 1997 New Melones Interim Plan of Operations (IPO) without implementation of the Vernalis Adaptive Management Program (VAMP), as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations.

3.4 Development of Reasonable Alternatives

The National Environmental Policy Act (NEPA) regulations and DOI NEPA regulations (43 CFR Section 46.415(b)) require an EIS to include a range of reasonable alternatives that meet the purpose and need of the proposed action, and address one or more significant issues related to the proposed action.

The DOI NEPA regulations also state that the lead agencies should include a consensus-based alternatives consistent with the purpose and need of the proposed project that are proposed by participating persons, organizations, or communities who may be interested in or affected by the proposed project when one exists. No alternatives or alternative concepts submitted to Reclamation during preparation of this EIS were identified as a consensus-based alternative.

Identification of the range of alternatives was developed for this EIS through the development of screening criteria based upon the purpose of the action; comparison of alternative concepts identified by Reclamation, stakeholders, and agencies to the screening criteria; and review of the identified range of alternatives to determine if the range of alternatives addresses the significant issues.

3.4.1 Application of Screening Criteria to the Range of Alternative Concepts

The screening criteria developed for this EIS is based upon the purpose of the action, as described in Chapter 2, Purpose and Need for the Action. The purpose of the action is:

- To continue the operation of the CVP, in coordination with operation of the SWP, for the authorized purposes, in a manner that:
  - Is similar to historic operational parameters with certain modifications;
  - Is consistent with Federal Reclamation law; other Federal laws; Federal permits and licenses; State of California water rights, permits, and licenses; and
  - Enables Reclamation and DWR to satisfy their contractual obligations to the fullest extent possible.

A number of alternative concepts were identified during the scoping process and through meetings with stakeholders and agencies during preparation of this EIS. These concepts were compared to the purpose of the action, as summarized in Table 3.1. Most of the concepts were incorporated into alternatives to be evaluated in detail in this EIS. Further discussion of concepts not included in the alternatives evaluated in detail in this EIS is presented in Section 3.4.8, Alternatives Considered but Not Evaluated in Detail.

Table 3.1 Application of Screening Criteria to Alternative Concepts Identified for Consideration in the EIS

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
Concept 1. CVP and SWP Operations without actions defined in the 2008 USWS BO RPA and 2009 NMFS BO RPA	Possibly	Yes	Yes, included in Alternatives 1, 3, and 4
Concept 2. Modify actions defined in the 2008 USWS BO RPA and 2009 NMFS BO RPA in a manner that would increase CVP and SWP deliveries	Possibly	Yes	Yes, included in Alternatives 1, 3, and 4
Concept 3. Modify actions defined in the 2008 USWS BO RPA and 2009 NMFS BO RPA in a manner that would reduce reverse flows and increase Delta outflow in the spring.	Possibly	Yes	Yes, included in Alternative 5
Concept 4. Modify actions defined in the 2008 USWS BO RPA and 2009 NMFS BO RPA in a manner that would increase primary productivity and flood supply for aquatic resources	Possibly	Yes	Yes, included in Alternatives 1, 3, 4, and 5
Concept 5. Modify actions defined in the 2008 USWS BO RPA and 2009 NMFS BO RPA in a manner that would modify the triggers for OMR criteria to protect Delta Smelt as follows: a) Reduce OMR criteria to a level between -5,000 cfs and -3,500 cfs only when appropriate based on analysis of turbidity levels and normalized salvage data in the south Delta b) Reduce OMR to no more negative than -5,000 cfs when more than	Possibly	Yes	Yes, included in Alternative 3

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
25 percent of the Delta Smelt collected in the spring kodiak or 20 mm trawl are located in the south Delta or the adult cumulative salvage index immediately preceding spawning is high; lift this restriction if Qwest is >12,000 cfs and/or secchi depth in the south Delta is >85 cm Do not implement RPA actions in the 2008 USFWS BO or 2009 NMFS BO			
Concept 6. Modify actions defined in the 2009 NMFS BO RPA related to the Interim Criteria for the San Joaquin River Inflow:Export ratio as follows for April 1 through May 30: Flows in San Joaquin River at Vernalis (7-day running average shall not be less than 7 percent of the target requirement) shall be based on the New Melones Index (as described in 2009 NMFS BO RPA Action IV.2.1) as follows for January 1 through June 15: a) If the Index is 999 TAF or less - no minimum flow requirement b) If the Index is 1000-1399 TAF - minimum flow is the greater of the SWRCB D-1641 requirement or 1500 cfs c) If the Index is 1400-1999 TAF - minimum flow is the greater of the SWRCB D-1641 requirement or 3000 cfs d) If the Index is 2000-	Possibly	Yes	No, this criteria is not implementable following the completion of the Vernalis Adaptive Management Program. Other flow criteria for the San Joaquin River at Vernalis are included in the range of alternatives, however this concept is informed the development of other alternative concepts evaluated in this EIS.

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
2499 TAF - minimum flow is 4500 cfs e) If the Index is above 2499 TAF - minimum flow is 6000 cfs Do not implement RPA actions in the 2008 USFWS BO or 2009 NMFS BO			
Concept 7. Implement predator control programs for Black Bass, Striped Bass, and Pikeminnow to protect salmonids and Delta Smelt as follows: a) Black Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 10 b) Striped Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 5 c) Establish a Pikeminnow sport-fishing reward program with a 8-inch limit at $2/fish	Yes	Yes	Yes, included in Alternatives 3 and 4
Concept 8. Restore or create at least 10,000 acres of tidally influenced seasonal or perennial wetlands. Do not implement other wetlands restoration RPA actions in the 2008 USFWS BO or 2009 NMFS BO	Yes	Yes	Yes, included in Alternatives 3 and 4
Concept 9. Establish a trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River in March through June as follows: a) Begin operation of downstream migrant fish traps upstream of the Head of Old River on the	Yes	Yes	Yes, included in Alternatives 3 and 4

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
San Joaquin River b) "Barge" all captured juvenile salmonids through the Delta, release at Chipps Island. c) Tag subset of fish in order to quantify effectiveness of the program d) Attempt to capture 10 percent to 20 percent of outmigrating juvenile salmonids			
Concept 10. Work with Pacific Fisheries Management Council, CDFW, and NMFS to minimize harvest mortality of natural origin Central Valley Chinook Salmon, including fall-run Chinook Salmon, by evaluating and modifying ocean harvest for consistency with Viable Salmonid Population Standards; including harvest management plan to show that abundance, productivity, and diversity (age-composition) are not appreciably reduced	Maybe	Yes	Yes, included in Alternative 3
Concept 11. Work with Pacific Fisheries Management Council, CDFW, and NMFS to impose salmon harvest restrictions to reduce by-catch of winter-run and spring-run Chinook Salmon to less than 10 percent of age-3 cohort in all years	Maybe	Yes	Yes, included in Alternative 4
Concept 12. Limiting floodplain development to protect salmonids and Delta Smelt by implementing the following actions:	Possibly	Yes	Yes, included in Alternative 4

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
a) Incorporate guidance into flood hazard mapping to help communities comply with the ESA b) Require communities to demonstrate ESA compliance for all flood plain map revisions c) Prioritize consideration of ESA listed species and critical habitat when selecting flood insurance studies d) Develop and implement floodplain management criteria e) Refine community rating system to provide credits for natural and beneficial functions f) Prohibit new development and substantial improvements to existing development within any designated floodway or within 170 feet of the ordinary high water line of any floodway			
Concept 13. Do not implement USACE requirements for vegetation on levees, and instead bar removal of vegetation from levees, require planting of trees and shrubs on levees, and armor levees with vegetation, woody material, and root re-enforcement material instead of riprap	Possibly	Yes	Yes, included in Alternative 4
Concept 14. Advance the timing of upgrades at the Sacramento Regional Wastewater Treatment Plant to 2017; and implement advanced treatment technologies at the Fairfield-Suisun Sewer	Yes	Yes	No, these actions are under construction and will be complete by 2030, per the requirements of the SWRCB and the related Regional Water Quality Control Boards

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
District treatment plant to reduce nutrients in the effluent			
Concept 15. Expand the current period of time for water transfers addressed in the operations consulted on in the 2008 USFWS BO and 2009 NMFS BO from July through September to year-round	Possibly	Yes	Yes, included in Alternative 4
Concept 16. Include measures to support Federal and state fish-doubling goals, including the goals of CVPIA	Yes	Yes	Yes, included in Alternatives 1, 2, 3, 4, and 5 as part of ongoing implementation of CVPIA
Concept 17. Operate the CVP and SWP to avoid “dead-pool” conditions in Shasta Lake, Folsom Lake, and Lake Oroville	Possibly	Yes	Yes, included in Alternatives 1, 2, 3, 4, and 5 as part of overall CVP and SWP operations
Concept 18. Change CVP water operations to meet all in-basin water demands for the Trinity, Sacramento, American, and Stanislaus rivers watersheds before meeting other CVP water demands	No	Yes	No, this concept would not be consistent with the purpose for the action
Concept 19. Implement operations of the New Melones Reservoir in accordance with the 2012 Oakdale Irrigation District and South San Joaquin Irrigation District Operations Plan	Possibly	Yes	Yes, included in Alternative 3
Concept 20. Reduce reliance of the CVP and SWP water users on water exported from the Delta through development of regional and local water supplies	Possibly	Yes	Yes, included in Alternatives 1, 2, 3, 4, and 5 as part of overall statewide water operations
Concept 21. Changes to methods used to monitor	Possibly	Maybe	No, this EIS analyzes overall operational

Alternative Concept	Consistent with Purpose for the Action	Addresses One or More Significant Issues	Include in One or More of the Alternatives Evaluated in the Draft EIS
and predict OMR flow criteria, including exclusion of Contra Costa Water District diversions from the calculations			concepts for the CVP and SWP. Specific methods to monitor and predict operations will be developed under separate efforts by Reclamation
Concept 22. Prioritize use of CVPIA restoration funds within watersheds in accordance with the amount of restoration funds collected in each watershed (e.g., the most funds would be highest in the watershed that generates the highest CVPIA restoration fund based upon water sales)	No	No	No, would not be consistent with CVPIA
Concept 23. Completely cease operations of the CVP and SWP facilities	No	No	No, this concept would not be consistent with the purpose for the action

Note:
Concepts identified as "possibly consistent with the purpose of the action" would require development of additional details and evaluation to determine if the concept is consistent with the stated purpose for the action, as described in Chapter 2, Purpose and Need for the Action. Concepts identified as "possibly consistent with the purpose of the action" were integrated into one or more of the alternatives evaluated in this EIS.

Based upon the comparison of screening criteria to the alternative concepts developed by Reclamation 17 of the 23 alternative concepts would be included in one or more of the alternatives evaluated in this EIS. The next step in the development of the alternatives is to combine the alternative concepts into specific alternatives and determine if the range of alternatives is adequate to address the significant issues in implementing a program that supports the purpose of the action.

3.4.2 Identification of Alternatives

The 17 alternative concepts were compiled into five alternatives. Development of the alternatives was informed by comments received about the alternative concepts. For example, numerous comments were received to evaluate an alternative that included assumptions identical to the Second Basis of Comparison assumptions in which the 2008 USFWS BO and 2009 NMFS BO would not be implemented. One of the scoping comments identified specific alternatives that included several alternative concepts included in Table 3.1; however, some of the specified alternative concepts were not consistent with assumptions for the Year 2030 and were modified to reflect implementable concepts.

Several of the alternative concepts are consistent with the No Action Alternative assumptions related to actions that would have occurred with or without implementation of the 2008 USFWS BO and 2009 NMFS BO. Therefore, the following alternative concepts are included under the No Action Alternative, Second Basis of Comparison, and all other alternatives.

- Alternative Concept 8 to restore or create at least 10,000 acres of tidally-influenced seasonal or perennial wetlands.
- Alternative Concept 16 to support the fish-doubling goals under CVPIA and state ecosystem restoration programs.
- Alternative Concept 17 to operate the CVP and SWP to avoid dead-pool conditions in the CVP and SWP reservoirs, to the extent possible based upon hydrologic conditions.
- Alternative Concept 20 to increase regional and local water supplies that could be used when CVP and SWP water supplies are reduced due to hydrologic and regulatory restrictions.

Using these concepts, the alternative concepts were combined into Alternatives 1 through 5 in a manner to avoid conflicts between concepts within an alternative. The descriptions of Alternatives 1 through 5 are presented below.

3.4.3 Alternative 1

Alternative 1 was created because many comments requested an alternative that reflected conditions without implementation of the 2008 USFWS BO and the 2009 NMFS BO. Since the Second Basis of Comparison is not a true alternative, in accordance with NEPA guidelines, Reclamation could not select Second Basis of Comparison as a preferred alternative. Therefore, Alternative 1 was defined as being identical to the Second Basis of Comparison, as defined in Section 3.3.2.

3.4.4 Alternative 2

Alternative 2 was first included in the Notice of Intent and identified as a “preliminary proposed action” that included the operational actions of the 2008 USFWS BO and 2009 NMFS BO. Alternative 2 does not include RPA actions that would require future studies and environmental documentation to define recommended actions (generally, structural actions).

The definition of Alternative 2 is based upon the following assumptions that are briefly described below.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB and implementation of the 2008 USFWS BO and 2009 NMFS BO, as described under the No Action Alternative.

- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs, as described above for the No Action Alternative in Sections 3.4.1.2 and 3.4.1.3.
- Implementation of future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS.

Alternative 2 conditions assume that climate change conditions would have changed between 2015 and 2030. It is anticipated that by 2030, there will be less snowfall over the long-term average conditions and higher mean sea level elevations.

Alternative 2 would not include actions in the 2008 USFWS BO and 2009 NMFS BO that have not been fully defined at this time; and therefore, would require future engineering and environmental evaluation prior to implementation. These following actions are not included in Alternative 2.

- 2009 NMFS BO RPA Action I.2.5, Winter-Run Passage and Re-Introduction Program at Shasta Dam.
- 2009 NMFS BO RPA Action II.3, Structural Improvements for Temperature Management on the American River.
- 2009 NMFS BO RPA Action II.5, Fish Passage at Nimbus and Folsom Dams.
- 2009 NMFS BO RPA Action II.6, Implement Actions to Reduce Genetic Effects of Nimbus and Trinity River Fish Hatchery Operations.
- 2009 NMFS BO RPA Action III.2.1, Increase and Improve Quality of Spawning Habitat with Addition of Gravel.
- 2009 NMFS BO RPA Action III.2.2, Conduct Floodplain Restoration and Inundation Flows in Winter or Spring to Inundate Steelhead Juvenile Rearing Habitat on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.3, Restore Freshwater Migratory Habitat for Juvenile Steelhead on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.4, Fish Passage at New Melones, Tulloch, and Goodwin Dams.
- 2009 NMFS BO RPA Action IV.4, Tracy Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.2 Skinner Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.3 Tracy Fish Collection Facility and the Skinner Fish Collection Facility Actions to Improve Salvage Monitoring, Reporting and Release Survival Rates.

3.4.4.1 Continued Long-Term Operation of the CVP and SWP Facilities

The CVP and SWP operations and ongoing operational management policies of the CVP and SWP under Alternative 2 would be identical to the operational assumptions described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations.

3.4.4.2 Actions in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Actions included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred with or without the BOs, would be identical under Alternative 2 as under the No Action Alternative and the Second Basis of Comparison.

3.4.4.3 Future Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Alternative 2 also includes assumptions unrelated to implementation of the 2008 USFWS BO and 2009 NMFS BO, including: climate change and sea level rise; development of lands in accordance with general plans in areas served by CVP and SWP water supplies; and reasonable and foreseeable projects that have been approved and are anticipated to be implemented by 2030. These items included in Alternative 2 are identical as under the No Action Alternative and the Second Basis of Comparison.

3.4.5 Alternative 3

Alternative 3 was developed based upon a scoping comment from the Coalition for a Sustainable Delta which identified "RPA Alternative 1," and a scoping comment received from Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID) (included in the Scoping Report in Appendix 23A of this EIS). The definition of Alternative 3 is based upon the following assumptions that are briefly described below.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; without the operational requirements of the 2008 USFWS BO and the 2009 NMFS BO; plus implementation of the 2012 operations plan for New Melones Reservoir proposed by OID and SSJID.
- Implementation of actions described in the Coalition for a Sustainable Delta scoping comment letter related to "RPA Alternative 1."
- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs, as described above for the No Action Alternative in Sections 3.4.1.2 and 3.4.1.3.

- Implementation of future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS.

Alternative 3 would not include implementation of actions described in the 2008 USFWS BO and 2009 NMFS BO that would not occur by 2030 without implementation of the BOs.

Alternative 3 conditions assume that climate change conditions would have changed between 2015 and 2030. It is anticipated that by 2030, there will be less snowfall over the long-term average conditions and higher mean sea level elevations.

3.4.5.1 Continued Long-Term Operation of the CVP and SWP Facilities

The CVP and SWP operations and ongoing operational management policies of the CVP and SWP under Alternative 3 would be similar to the operational assumptions under the Second Basis of Comparison with the following changes to water demand assumptions, OMR criteria, and operations of New Melones Reservoir to meet SWRCB D-1641 flow requirements on the San Joaquin River at Vernalis.

Alternative 3 would include additional demands for American River water supplies as compared to the No Action Alternative or Second Basis of Comparison. The additional demands would provide water supplies of up to 17 TAF/year under a Warren Act Contract for El Dorado Irrigation District and 15 TAF/year under a Warren Act Contract for El Dorado County Water Agency.

3.4.5.1.1 Old and Middle River Criteria

The OMR flow criteria under Alternative 3 are based on concepts addressed in the 2008 USFWS BO and 2009 NMFS BO related to adaptive restrictions for temperature, turbidity, salinity, and presence of Delta Smelt. The OMR flow criteria in the Alternative 3 are similar to those of the No Action Alternative, as described in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations, with the exception of the following changes:

- Reduce OMR criteria to a level between -5,000 cfs and -3,500 cfs only when appropriate based on analysis of turbidity levels and normalized salvage data in the south Delta

- Reduce OMR to no more negative than -5,000 cfs when more than 25 percent of the Delta Smelt collected in the spring kodiak or 20 mm trawl are located in the south Delta or the adult cumulative salvage index immediately preceding spawning is high; lift this restriction if Qwest is >12,000 cfs and/or secchi depth in the south Delta is >85 cm

For the purpose of quantitative analysis in this EIS, the numerical model represented this concept with the following assumptions.

- Action 1 that protects the pre-spawning adult Delta Smelt from entrainment is modified to limit exports such that the average daily OMR flow is no more negative than -3,500 cfs for a total duration of 14 days, with a 5-day running average no more negative than -4,375 cfs (within 25 percent of the monthly criteria).

- Action 2 that protects adult Delta Smelt within the Delta from entrainment is modified to limit exports so that the average daily OMR flow is no more negative than -3,500 or -7,500 cfs depending on the previous month's ending X2 location (-3,500 cfs if X2 is east of Roe Island, or -7,500 cfs if X2 is west of Roe Island), with a 5-day running average within 25 percent of the monthly criteria (no more negative than -4,375 cfs if X2 is east of Roe Island, or -9,375 cfs if X2 is west of Roe Island).
- Action 3 that protects larval and juvenile Delta Smelt from entrainment is modified to limit exports so that the average daily OMR flow is no more negative than -1,250, -3,500, or -7,500 cfs, depending on the previous month's ending X2 location (-1,250 cfs if X2 is east of Chipps Island, -7,500 cfs if X2 is west of Roe Island, or -3,500 cfs if X2 is between Chipps and Roe Island, inclusively), with a 5-day running average within 25 percent of the monthly criteria (no more negative than -1,562 cfs if X2 is east of Chipps Island, -9,375 cfs if X2 is west of Roe Island, or -4,375 cfs if X2 is between Chipps and Roe Island).
- Temporal off-ramp for Action 3 is assumed to occur no later than June 15 (changed from June 30).
- An off-ramp based on QWest (westerly flow on the San Joaquin River past Jersey Point calculated as a combination of San Joaquin River at Blind Point, Three Mile Slough and Dutch Slough) is assumed. If Qwest is greater than 12,000 cfs, then the Action 3 is discontinued. Because Action 2 is defined to occur between Actions 1 and 3, the Qwest off-ramp also results in discontinuation of Action 2 if it happens before Action 3 is triggered. In monthly CalSim II modeling, previous month's QWest value is used for determining the off-ramp, therefore if the off-ramp occurs within the previous month, actions in that previous month are assumed to continue until the end of the month.

3.4.5.1.2 New Melones Operations Criteria

Alternative 3 assumes that the flood control operations for the New Melones Reservoir would be the same as under the No Action Alternative. However, New Melones Reservoir would be operated for different fishery flows, water quality flows, and San Joaquin River base flows and pulse flows at Vernalis.

Fishery

In the Alternative 3 simulation, fishery flows are modeled per the OID and SSJID 2012 operations proposal, as summarized in Tables 3.2 through 3.4. These flows include an outmigration pulse flow from April 1 through May 15. Total annual volume dedicated to fishery flows vary from 174 to 318 TAF depending on the hydrologic conditions defined by the New Melones water supply forecast (the end-of-February New Melones Storage, plus the March - September forecast of inflow to the reservoir).

Table 3.2 Annual Fishery Flow Allocation in New Melones

Melones Water Supply Forecast (TAF)	Fishery Base Flows (TAF)
0 to 1,800	174
1,801 to 2,500	235
>2,500	318

Table 3.3 Monthly "Base" Flows for Fisheries Purposes Based on the Annual Fishery Volume

Annual Fishery Flow Volume (TAF)	Monthly Fishery Base Flows (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
235	252	300	300	150	173	200	200	200	200	200	200	200
318	300	300	300	300	300	300	1,500	850	200	200	200	200

Table 3.4 April 1 through May 31 "Pulse" Flows for Fisheries Purposes Based on the Annual Fishery Volume

Melones Water Supply Forecast (TAF)	Fishery Pulse Flows (CFS) April 1 –May 31
0 to 1,800	750
1,801 to 2,500	1,500
>2,500	1,500

Water Quality

Alternative 3 assumes that no water is released from New Melones Reservoir to meet the SWRCB D-1641 water quality criteria in the San Joaquin River. Water is released to meet the SWRCB D-1422 DO criteria; however, the compliance point is moved from Ripon to the Orange Blossom Bridge under the Alternative 3.

Bay-Delta Flows

Alternative 3 assumes that no water is released from New Melones Reservoir to meet the SWRCB D-1641 Bay-Delta flow requirements on the San Joaquin River at Vernalis for base flows or pulse flows.

3.4.5.2 Actions Related to Predation Control, Wetlands Restoration, Juvenile Salmonid Trap and Haul Program, and Chinook Salmon Ocean Harvest

Alternative 3 includes the following actions as described in "RPA Alternative 1" in the Coalition for a Sustainable Delta scoping comment.

- Implement predator control programs for Black Bass, Striped Bass, and Pikeminnow to protect salmonids and Delta Smelt as follows:
  - Black Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 10
  - Striped Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 5
  - Establish a Pikeminnow sport-fishing reward program with a 8-inch limit at $2/fish
- Restore or create at least 10,000 acres of tidally influenced seasonal or perennial wetlands. These conditions are the same as under the No Action Alternative and Second Basis of Comparison.
- Establish a trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River in March through June as follows:
  - Begin operation of downstream migrant fish traps upstream of the Head of Old River on the San Joaquin River
  - "Barge" all captured juvenile salmonids through the Delta, release at Chipps Island.
  - Tag subset of fish in order to quantify effectiveness of the program
  - Attempt to capture 10 percent to 20 percent of out-migrating juvenile salmonids
- Work with Pacific Fisheries Management Council, CDFW, and NMFS to minimize harvest mortality of natural origin Central Valley Chinook Salmon, including fall-run Chinook Salmon, by evaluating and modifying ocean harvest for consistency with Viable Salmonid Population Standards; including harvest management plan to show that abundance, productivity, and diversity (age-composition) are not appreciably reduced.

3.4.5.3 Actions in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Actions included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred with or without the BOs, would be identical under Alternative 3 as under the No Action Alternative and the Second Basis of Comparison.

3.4.5.4 Future Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Alternative 3 also includes assumptions unrelated to implementation of the 2008 USFWS BO and 2009 NMFS BO, including: climate change and sea level rise; development of lands in accordance with general plans in areas served by CVP and SWP water supplies; and reasonable and foreseeable projects that have been approved and are anticipated to be implemented by 2030. These items included in Alternative 3 are identical as under the No Action Alternative and the Second Basis of Comparison.

3.4.6 Alternative 4

Alternative 4 was developed based upon a scoping comment from the Coalition for a Sustainable Delta which identified "RPA Alternative 2" (included in the Scoping Report in Appendix 23A of this EIS). The definition of Alternative 4 is based upon the following assumptions that are briefly described below.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; without the operational requirements of the 2008 USFWS BO and the 2009 NMFS BO, as described under Second Basis of Comparison.
- Implementation of actions described in the Coalition for a Sustainable Delta scoping comment letter related to "RPA Alternative 2."
- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs, as described above for the No Action Alternative in Sections 3.4.1.2 and 3.4.1.3.
- Implementation of future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS.

Alternative 4 would not include implementation of actions described in the 2008 USFWS BO and 2009 NMFS BO that would not occur by 2030 without implementation of the BOs.

The "RPA Alternative 2" also included a provision to "Advance the timing of upgrades at the Sacramento Regional Wastewater Treatment Plant to 2017; and implement advanced treatment technologies at the Fairfield-Suisun Sewer District treatment plant to reduce nutrients in the effluent." However, both of these actions would be complete by 2030, the study period considered in this EIS. The Sacramento Regional Wastewater Treatment Plant must comply with the National Pollutant Discharge Elimination System permit issued on December 9, 2010 by the Central Valley Regional Water Quality Control Board to reduce nutrients in the effluent discharged to the Sacramento River by 2020 (SRCSD 2012). The Fairfield Suisun Sewer District must comply with similar permit conditions issued by the San Francisco Bay Regional Water Quality Control Board in March 2015

(SFRRWQCB 2015). Because the Environmental Consequences analysis in this EIS is conducted as a "snapshot" in time at 2030, inclusion of a provision to require compliance with the discharge requirements prior to 2020 could not be evaluated.

Alternative 4 conditions assume that climate change conditions would have changed between 2015 and 2030. It is anticipated that by 2030, there will be less snowfall over the long-term average conditions and higher mean sea level elevations.

3.4.6.1 Continued Long-Term Operation of the CVP and SWP Facilities

The ongoing operational management policies of the CVP and SWP under Alternative 4 would be identical to operations described under the Second Basis of Comparison.

3.4.6.2 Actions Related to Floodplain Protection, Levee Vegetation, Predation Control, Wetlands Restoration, Juvenile Salmonid Trap and Haul Program, and Chinook Salmon Ocean Harvest

Alternative 4 includes the following actions as described in "RPA Alternative 1" in the Coalition for a Sustainable Delta scoping comment.

- Limiting floodplain development to protect salmonids and Delta Smelt by implementing the following actions:
  - Incorporate guidance into flood hazard mapping to help communities comply with the ESA
  - Require communities to demonstrate ESA compliance for all flood plain map revisions
  - Prioritize consideration of ESA listed species and critical habitat when selecting flood insurance studies
  - Develop and implement floodplain management criteria
  - Refine community rating system to provide credits for natural and beneficial functions
  - Prohibit new development and substantial improvements to existing development within any designated floodway or within 170 feet of the ordinary high water line of any floodway
- Modify the requirements of the USACE related to removal of vegetation on levees. USACE requires removal of vegetation on levees. DWR and USACE have been working to develop a plan that would allow for the continuation of existing vegetation on levees until levee maintenance or repairs requires removal of the vegetation. Under Alternative 4, trees and shrubs would be planted along the levees; and vegetation, woody material, and root re-enforcement material would be installed on the levees instead of riprap for erosion protection.

- Implement predator control programs for Black Bass, Striped Bass, and Pikeminnow to protect salmonids and Delta Smelt as follows:
  - Black Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 10
  - Striped Bass catch limit changed to allow catch of 12-inch fish with a bag limit of 5
  - Establish a Pikeminnow sport-fishing reward program with a 8-inch limit at $2/fish
- Restore or create at least 10,000 acres of tidally influenced seasonal or perennial wetlands. These conditions are the same as under the No Action Alternative and Second Basis of Comparison.
- Establish a trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River in March through June as follows:
  - Begin operation of downstream migrant fish traps upstream of the Head of Old River on the San Joaquin River
  - "Barge" all captured juvenile salmonids through the Delta, release at Chipps Island.
  - Tag subset of fish in order to quantify effectiveness of the program
  - Attempt to capture 10 percent to 20 percent of outmigrating juvenile salmonids
- Work with Pacific Fisheries Management Council, CDFW, and NMFS to impose salmon harvest restrictions to reduce by-catch of winter-run and spring-run Chinook Salmon to less than 10 percent of age-3 cohort in all years

3.4.6.3 Actions in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Actions included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred with or without the BOs, would be identical under Alternative 4 as under the No Action Alternative and the Second Basis of Comparison.

3.4.6.4 Future Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Alternative 4 also includes assumptions unrelated to implementation of the 2008 USFWS BO and 2009 NMFS BO, including: climate change and sea level rise; development of lands in accordance with general plans in areas served by CVP and SWP water supplies; and reasonable and foreseeable projects that have been approved and are anticipated to be implemented by 2030. These items included in Alternative 4 are identical as under the No Action Alternative and the Second Basis of Comparison.

3.4.7 Alternative 5

Alternative 5 is similar to the No Action Alternative with positive OMR criteria in April and May which causes increased Delta outflow; and use of the SWRCB D-1641 pulse flow at Vernalis. Alternative 5 was developed considering comments from environmental interest groups during the scoping process. Alternative 5 also provides another method to operate the New Melones Reservoir as compared to the other alternatives.

The definition of Alternative 5 is based upon the following assumptions that are briefly described below.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; and the operational requirements of the 2008 USFWS BO and the 2009 NMFS BO.
- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs, as described above for the No Action Alternative in Sections 3.4.1.2 and 3.4.1.3.
- Implementation of actions described in the 2008 USFWS BO and 2009 NMFS BO that would not occur by 2030 without implementation of the BOs.
- Implementation of future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS.

Alternative 5 conditions assume that climate change conditions would have changed between 2015 and 2030. It is anticipated that by 2030, there will be less snowfall over the long-term average conditions and higher mean sea level elevations.

3.4.7.1 Continued Long-Term Operation of the CVP and SWP Facilities

The CVP and SWP operations and ongoing operational management policies of the CVP and SWP under Alternative 5 would be similar to the operational assumptions under the No Action Alternative with the following changes to water demand assumptions, OMR criteria, and operations of New Melones Reservoir to meet SWRCB D-1641 flow requirements on the San Joaquin River at Vernalis.

3.4.7.1.1 Water Demands

Alternative 5 would include additional water demands for users of water from the American River watershed as compared to the No Action Alternative or Second Basis of Comparison. Under Alternative 5, up to 17 TAF/year would be provided to the El Dorado Irrigation District under a Warren Act Contract to allow water to be conveyed through Folsom Lake; and up to 15 TAF/year would be provided to El Dorado County Water Agency under a separate Warren Act contract.

3.4.7.1.2 Old and Middle River Criteria

The OMR flow criteria under Alternative 5 is similar to the assumptions under the No Action Alternative and based on concepts addressed in the 2008 USFWS BO and 2009 NMFS BO plus a requirement for positive OMR (no reverse flows) in April and May of all water year types.

3.4.7.1.3 New Melones Operations Criteria

Alternative 5 assumptions for New Melones Reservoir operations are similar to assumptions under the No Action Alternative except for SWRCB D-1641 requirements for the San Joaquin River pulse flows at Vernalis, as summarized in Table 3.5.

Table 3.5 Bay-Delta Vernalis Flow Objectives (average monthly cfs)

60-20-20 Index	Pulse Flow Required if X2 is West of Chipps Island	Pulse Flow required if X2 is East of Chipps Island
Wet	8,620	7,330
Above Normal	7,020	5,730
Below Normal	5,480	4,620
Dry	4,880	4,020
Critical	3,540	3,110

3.4.7.2 Actions in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Actions included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred with or without the BOs, would be identical under Alternative 5 as under the No Action Alternative and the Second Basis of Comparison.

3.4.7.3 Actions in the 2009 NMFS BO that Would Not Have Occurred without Implementation of the Biological Opinions

Actions included in the 2008 USFWS BO and 2009 NMFS BO that would not have occurred without the BOs, would be identical under Alternative 5 as under the No Action Alternative.

3.4.7.4 Future Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions

Alternative 5 also includes assumptions unrelated to implementation of the 2008 USFWS BO and 2009 NMFS BO, including: climate change and sea level rise; development of lands in accordance with general plans in areas served by CVP and SWP water supplies; and reasonable and foreseeable projects that have been approved and are anticipated to be implemented by 2030. These items included in Alternative 5 are identical as under the No Action Alternative and the Second Basis of Comparison.

3.4.8 Alternatives Considered but Not Evaluated in Detail

As described above, 6 of the 23 alternative concepts identified for inclusion in the alternatives to be evaluated in this EIS were eliminated for further evaluation for several reasons, as described below.

3.4.8.1 Alternative Concept 6: Modify Flows in San Joaquin River at Vernalis

The 2009 NMFS BO included two phases related to implementation of the San Joaquin River Inflow to Export Ratio. The first phase, to be implemented in 2010 and 2011, assumed CVP and SWP operations under the Vernalis Adaptive Management Plan (VAMP) which provided for Reclamation to purchase water from non-CVP water users in the San Joaquin River watershed. The second phase was designed to be implemented following the completion of VAMP when Reclamation could no longer purchase water to meet flow requirements of the SWRCB D-1641 in the Delta.

Alternative Concept 6 recommended an operations that CVP could not meet without VAMP authorizations. Therefore, Alternative Concept 6 did not meet the provision in the purpose of the action to be "consistent with Federal Reclamation law; other Federal laws; Federal permits and licenses; State of California water rights, permits, and licenses." Alternative Concept 6 was not retained for analysis in the EIS.

3.4.8.2 Alternative Concept 14: Advance the Timing of Upgrades at Wastewater Treatment Plants

Alternative Concept 14 would advance the timing of upgrades at the Sacramento Regional Wastewater Treatment Plant to 2017; and implement advanced treatment technologies at the Fairfield-Suisun Sewer District treatment plant to reduce nutrients in the effluent." However, both of these actions would be complete by 2030, the study period considered in this EIS. The Sacramento Regional Wastewater Treatment Plant must comply with the National Pollutant Discharge Elimination System permit issued on December 9, 2010 by the Central Valley Regional Water Quality Control Board to reduce nutrients in the effluent discharged to the Sacramento River by 2020 (SRCSD 2012). The Fairfield Suisun Sewer District must comply with similar permit conditions issued by the San Francisco Bay Regional Water Quality Control Board in March 2015 (SFRRWQCB 2015).

Because the Environmental Consequences analysis in this EIS is conducted as a "snapshot" in time at 2030, inclusion of a provision to require compliance with the discharge requirements prior to 2020 would not be evaluated. Therefore, Alternative Concept 14 was not retained for analysis in the EIS.

3.4.8.3 Alternative Concept 18: Change to CVP Operations to Meet In-Basin Water Demands prior to Meeting other CVP Water Demands

Alternative Concept 18 would require operations of the CVP to meet in-basin water demands in the Trinity, Sacramento, American, and Stanislaus rivers watersheds prior to use of the CVP water in other portions of the service area. However, the CVP is operated as integrated system to satisfy statutory, regulatory, and contractual obligations to the fullest extent possible, in accordance with the purpose of the action. Therefore, Alternative Concept 18 was not retained for analysis in the EIS.

3.4.8.4 Alternative Concept 21: Change methods used to monitor and predict OMR criteria

Alternative Concept 21 addresses an item that is related to methods to implement OMR monitoring and projections. The alternatives considered in this EIS address approaches to continued operation of the CVP and SWP. Methods to monitor and predict criteria used in CVP and SWP operations are considered by Reclamation as part of the operations of the CVP. Changes in methods used to monitor and predict OMR values can be applied to any of the alternatives considered in this EIS; and would not result in differentiations between alternatives. Therefore, Alternative Concept 21 was not retained for analysis in the EIS.

3.4.8.5 Alternative 22: Prioritize Use of CVPIA Restoration Funds in the Watersheds that Generated the Funds

As described above, the locations of CVPIA restoration activities are determined based upon scientific framework throughout the CVP service area that connects restoration actions to environmental and population responses across watersheds (Reclamation 2013c). A system-wide science-based approach with performance indices, monitoring, and scientific review of results is used to provide direction as the CVPIA adapts to changing conditions. Changing the approach from the current CVPIA implementation plan could be considered to be inconsistent with Federal law. Therefore, Alternative Concept 22 was not retained for analysis in the EIS.

3.4.8.6 Alternative 23: Completely Cease Operations of the CVP and SWP

Complete cessation of CVP and SWP operations would not be consistent with the requirement of the purpose of the action to operate the CVP and SWP in a manner that is similar to historic operational parameters with certain modifications; and it would not be consistent with Federal Reclamation law; other Federal laws; Federal permits and licenses; State of California water rights, permits, and licenses related to delivery of water by CVP and SWP to water rights holder and related to flood management operations at the CVP and SWP reservoirs. Therefore, Alternative Concept 23 was not retained for analysis in the EIS.

3.5 Assumptions for Cumulative Effects Analysis

The CEQ regulations define cumulative effects as the impact on environmental, human, and community resources that results from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7, 1508.25.) Future cumulative impacts should not be speculative but should be based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The reasonably foreseeable future actions included in the cumulative effects analysis are summarized below. The projects and actions are organized into:

- Water Supply and Water Quality Projects and Actions potentially affected by long-term operation of the SWP and CVP (organized geographically from north to south)
- Ecosystem Improvement Projects and Actions potentially affected by long-term operation of the SWP and CVP or potentially affecting resources analyzed in this EIS (organized geographically from north to south)

3.5.1 Water Supply and Water Quality Projects and Actions

There are numerous water supply and water quality projects and actions that could be potentially affected by changes in the coordinated long-term operation of the CVP and SWP, or could affect the CVP and SWP operations. Major future water supply and water quality projects and actions are discussed below.

3.5.1.1 Bay-Delta Water Quality Control Plan Update

In accordance with the federal Clean Water Act and the Porter-Cologne Water Quality Control Act, basin plans must be developed for each hydrologic area. Each basin plan must contain water quality objectives to ensure the reasonable protection of beneficial uses, as well as a program of implementation for achieving those objectives. Federal regulations require each state to adopt water quality standards to protect the public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. In California, the beneficial uses and water quality objectives form the basis of the water quality control standards. In the Sacramento-San Joaquin Bay Delta, water quality and flow objectives to meet water quality criteria are included in the Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (Bay-Delta WQCP) (SWRCB 2006). The SWRCB and the Central Valley and San Francisco Regional Water Quality Control Boards are in the process of updating the Bay-Delta WQCP. The updates, or amendments, are being prepared in two phases. Initially, the SWRCB and Regional Water Quality Control Boards are evaluating new flow objectives for the Lower San Joaquin River and the tributaries of Stanislaus, Tuolumne, and Merced rivers; and southern Delta salinity objectives. The second phase is evaluating changes to other portions of the Bay-Delta WQCP including Delta outflows, SWP and CVP export restrictions, and other requirements in the Bay-Delta to protect fish and wildlife beneficial uses. A third phase will consider and assign responsibility for implementing measures to achieve the water quality objectives established in the first two phases (SWRCB 2012).

Ongoing programs to adopt and implement total maximum daily loads are described in Chapter 6, Surface Water Quality.

3.5.1.2 Bay Delta Conservation Plan and the California Water Fix

The Bay Delta Conservation Plan, BDCP and the ongoing California Water Fix are being developed by federal and state agencies and other stakeholders to achieve the dual goals of a reliable water supply for California and a healthy California Bay Delta ecosystem that supports the State's economy. The program would construct a new conveyance facility and modify operation of existing CVP and SWP Delta facilities; and reduce ecological stressors that impair the function or the use of the Delta by aquatic and terrestrial resources.

The Recirculated Draft EIR/Supplemental Draft EIS (RDEIR/SDEIS) is currently being developed by DWR, Reclamation, USFWS, and NMFS. The RDEIR/SDEIS will evaluate new alternatives in addition to the alternatives included in the Public Draft EIR/EIS that combine ecosystem restoration approaches and Delta conveyance approaches. During the last 50 years, several broad conveyance approaches have been studied to address urban water quality, water supply reliability, and environmental concerns in the Delta: physical barriers, hydraulic barriers, through-Delta facilities, and isolated facilities. Several alternative Delta conveyance facilities are being evaluated as part of the EIR/EIS process. Among these alternatives are use of an isolated facility that would convey water around or under the Delta for local supply and export through a hydraulically isolated channel or pipeline and with continual use of the existing south Delta intakes (dual conveyance alternatives); and continuation of the use of the through-Delta conveyance with channel modifications

3.5.1.3 Shasta Lake Water Resources Investigation

The Shasta Lake Water Resources Investigation is currently being conducted by Reclamation to determine the type and extent of federal interest in a multiple purpose plan to modify Shasta Dam and Reservoir to increase the survival of anadromous fish populations in the upper Sacramento River; increase water supplies and water supply reliability for agricultural, municipal, industrial, and environmental purposes (Reclamation 2013d). To the extent possible through meeting these objectives, alternatives include features to benefit other identified water and related resource needs including ecosystem conservation and enhancement, improve hydropower generation capability, flood damage reduction, maintain and increase recreation opportunities, and maintain or improve water quality conditions in the Sacramento River and the Delta consistent with the objectives of the CALFED Bay-Delta Program. Anticipated alternatives for expansion of Shasta Lake include, among other features, raising the dam from 6.5 to 18.5 feet above current elevation, which would result in additional storage capacity of 256,000 to 634,000 acre-feet, respectively. The increased capacity is expected to improve water supply reliability and increase the cold water pool, which would provide improved water temperature conditions for anadromous fish in the Sacramento River downstream of the dam.

3.5.1.4 North of Delta Offstream Storage Investigation

The North-of-the-Delta Offstream Storage Investigation evaluates the feasibility of offstream storage in the northern Sacramento Valley for improved water supply and water supply reliability, improved water quality, and enhanced survival of anadromous fish and other aquatic species (DWR 2013). Specific primary planning objectives are to: 1) increase water supplies to meet existing contract requirements, including improved water supply reliability, and provide greater flexibility in water management for agricultural, environmental, and municipal and industrial users; 2) increase the survival of anadromous fish populations in the Sacramento River, as well as the survivability of other aquatic species; and 3) improve drinking water quality in the Delta. To the extent possible through meeting these objectives, alternatives include ecosystem conservation and enhancement, provide ancillary hydropower generation capability to the statewide power grid, and create incremental flood damage reduction opportunities in support of major northern California flood-control reservoirs consistent with the objectives of the CALFED Bay Delta Program. All alternatives include construction of a dam and reservoir near Sites, located to the west of Maxwell (California), with various facilities and configurations for conveyance into and out of the reservoir, which would result in additional storage capacity ranging from 1200 to 1900 TAF.

3.5.1.5 Federal Energy Regulatory Commission License Renewals

There are 22 hydroelectric generation FERC permits that will expire prior to 2030 (FERC 2015). Fifteen projects in the Sacramento River watershed include one on the Pit River (upstream of Shasta Lake), six on the Feather River, four on the Yuba River, one on the Bear River, one on the American River, and one each on Cow and Battle creeks. Projects in the San Joaquin River watershed include four on the San Joaquin River, one on the Stanislaus River, two on the Merced River, and one on the Tuolumne River. The FERC must complete analyses under NEPA and ESA to consider the effects of the hydropower operations on the environment, including flow regimes, water quality, fish passage, recreation, aquatic and riparian habitat, and special status species.

3.5.1.5.1 Federal Energy Regulatory Commission License Renewal for SWP Oroville Project

The Oroville Facilities, as part of SWP, are also operated for flood management, power generation, water quality improvement in the Delta, recreation, and fish and wildlife enhancement. The objective of the relicensing process was to continue operation and maintenance of the Oroville Facilities for electric power generation, along with implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license. The initial FERC license for the Oroville Facilities, issued on February 11, 1957, expired on January 31, 2007. The Final EIR/EIS were completed in 2007 (FERC 2007). At this time, the revised BOs and FERC license have not been issued.

3.5.1.5.2 Federal Energy Regulatory Commission Relicensing for Yuba River Watershed Hydroelectric Projects

The Nevada Irrigation District is applying for a new license for the Yuba-Bear Project (FERC Project No. 2266), and PG&E are applying for the Drum-Spaulding Project (FERC Project No. 2310). The Yuba-Bear Project is located on the Middle and South Yuba rivers, Bear River, and Jackson and Canyon creeks (FERC 2013). Concurrently, PG&E is applying for a license renewal for the Drum-Spaulding Project which is located on the Bear and Yuba rivers. Operations of the two projects are coordinated in many factors. The FERC relicensing processes for these two projects in underway.

3.5.1.6 El Dorado Water and Power Authority Supplemental Water Rights Project

The El Dorado Water and Power Authority (EDWPA) proposes to establish permitted water rights allowing diversion of water from the American River basin to meet planned future water demands in the El Dorado Irrigation District and Georgetown Divide Public Utility District service areas and other areas located within El Dorado County that are outside of these service areas. The EDWPA filed petitions with the SWRCB for partial assignment of State Filed Applications 5644 and 5645, and accompanying applications allowing for the total withdrawal and use of 40,000 acre-feet per year, consistent with the diversion and storage locations allowed under the El Dorado-Sacramento Municipal Utility District Cooperation Agreement (EDWPA 2010).

3.5.1.7 Semitropic Water Storage District Delta Wetlands

In 1987, Delta Wetlands, a California Corporation, proposed a project for water storage and wildlife habitat enhancement on four privately owned islands in the Delta. The four islands were Bacon Island and Bouldin Island in San Joaquin County and Holland Tract and Webb Tract in Contra Costa County, encompassing approximately 23,000 acres. The Delta Wetlands Project would store water on two Reservoir Islands (Bacon Island and Webb Tract) for subsequent release into the Delta, and habitat enhancement to compensate for wetland and wildlife effects of the water storage operations with a Habitat Management Plan on two Habitat Islands (Bouldin Island and Holland Tract).

In 2007, the Delta Wetlands Project partnered with the Semitropic Water Storage District (Semitropic WSD) to: 1) provide water to Semitropic WSD to augment its water supply, and 2) bank water within the Semitropic Groundwater Storage Bank and Antelope Valley Water Bank. The designated places of use for Delta Wetlands Project water would include: Semitropic WSD; Member Agencies of the Metropolitan Water District of Southern California, the Western Municipal Water District of Riverside County, and select service areas of the Golden State Water Company. The project would include improvements of 27 miles of levees and screened diversions to divert water during high-flow periods in the winter months of December through March into Webb Tract (100,000 acre-feet of storage) and Bacon Island (115,000 acre-feet of storage). The water would not be diverted in a manner that would adversely affect senior legal water rights holders, including the SWP and CVP. Stored water would be discharged into False River (from Webb Tract) and Middle River (from Bacon Island) for export when excess SWP or CVP diversion capacity is available, in the summer and fall months of July through November. Any water that could not be exported from the Delta in a given year would be available to increase Delta outflow in the fall months of September through November. Semitropic WSD issued a Draft EIR in 2010 and a Final EIR in 2011 (SWSD 2011).

3.5.1.8 North Bay Aqueduct Alternative Intake

DWR is evaluating the implementation of an alternative intake on the Sacramento River upstream of the Sacramento Regional Wastewater Treatment Plant, and conveyance facility to connect the intake with the existing North Bay Aqueduct. The proposed alternative intake would be operated in conjunction with the existing North Bay Aqueduct intake at Barker Slough. The proposed project would be designed to improve water quality and to provide reliable deliveries of SWP supplies to its contractors, the Solano County Water Agency and the Napa County Flood Control and Water Conservation District (DWR 2011).

The proposed project would include construction and operation of a 240 cfs capacity intake with state-of-the-art positive barrier fish screens, pumping plant, sediment basins, and ancillary support facilities located on the west side of the Sacramento River near south Sacramento. The conveyance facility would include an approximately 30 mile long, 72 to 84-inch diameter underground steel and/or concrete pipeline to convey the water from the alternate intake to the existing North Bay Aqueduct. Two options are proposed for the location of the alternate intake facility. Alternate intake site 1 is located on the outside edge of Garcia Bend of the Sacramento River (on the west bank), approximately 500 feet south of the boundary of the City of West Sacramento. Alternate intake site 2 is located immediately south of the outside edge of Garcia Bend of the Sacramento River (on the west bank), approximately 2,500 feet south of the boundary of the City of West Sacramento. The intake and pumping plant facility would be constructed on the water side of the Sacramento River levee and the remaining components would be constructed on the land side of the levee. The intake would extend about 100 feet from the top of the levee into the river. The exact amount of this extension would depend on the site option selected. A fish screen would be installed on the face of the intake structure to prevent fish from swimming or being drawn into the intake and it would be designed to meet CDFW, NMFS, and USFWS criteria. The dimensions of the fish screen would be based on an anticipated approach velocity of 0.2 feet per second at the fish screen. Flow-control louvers behind the screen would control flow rates through the screen to assure uniform water velocity across the screen. Normal operation would keep the top of the screen below low water elevation. A reduction in pumping would occur any time the screens are not submerged or the water velocities increased.

Above the screen would be concrete panels which extend to the 200 year flood elevation. A log boom would be installed in front of the fish screen to block large debris from blocking or damaging the intake. The intake would be equipped with an automatic fish screen cleaning system.

3.5.1.9 Los Vaqueros Reservoir Expansion Phase 2

Los Vaqueros Reservoir is an off-stream reservoir in the Kellogg Creek watershed to the west of the Delta. The Los Vaqueros Reservoir initial construction was completed in 1997 as a 100 TAF off-stream storage reservoir owned and operated by Contra Costa Water District to improve delivered water quality and emergency storage reliability to their customers. In 2012, the Los Vaqueros Reservoir was expanded to a total storage capacity of 160,000 acre-feet (Phase 1) to provide additional water quality and supply reliability benefits, and to adjust the timing of its Delta water diversions to accommodate the life cycles of Delta aquatic species, thus reducing species impact and providing a net benefit to the Delta environment. As part of the Storage Investigation Program described in the CALFED Bay Delta Program Record of Decision, additional expansion up to 275 TAF (Phase 2) is being evaluated by Contra Costa Water District, DWR, and Reclamation. The alternatives considered in the evaluation also consider methods to convey water from Los Vaqueros Reservoir to the South Bay Aqueduct to provide water to Zone 7 Water Agency, Alameda County Water District, and Santa Clara Valley Water District (Reclamation, CCWD, and Western 2010).

3.5.1.10 Upper San Joaquin River Basin Storage Investigation

The Upper San Joaquin River Basin Storage Investigation is being conducted by Reclamation and DWR to evaluate alternative plans to increase Upper San Joaquin River Storage to enhance the San Joaquin River restoration efforts and improve water supply reliability for agricultural, municipal and industrial, and environmental uses in the Friant Division, the San Joaquin Valley, and other regions of the state. The investigation is evaluating integration of conjunctive management and water transfer concepts into plan formulations. Additional storage is also expected to provide incidental flood damage reduction benefits (Reclamation 2014c).

Reclamation is analyzing alternatives for a new dam and a 1,260 TAF reservoir along the San Joaquin upstream of Millerton Lake in an area known as Temperance Flat. Primary planning objectives are to: 1) increase water supply reliability, and 2) enhance flow and temperature conditions to support the San Joaquin River Restoration Program. Operation variables include reservoir carryover, new or shifting water supply beneficiaries, and alternative conveyance routes.

3.5.1.11 FERC Relicense Renewal for Turlock Irrigation District and Modesto Irrigation District Don Pedro Project

The Don Pedro Project is located on the Tuolumne River in Tuolumne County. The initial license was issued for operations between 1971 and 1991 followed by requirements to evaluate fisheries water needs in the Tuolumne River.

In 1987, after the Turlock Irrigation District and Modesto Irrigation District applied to amend their license to add a fourth generating unit, FERC approved an amended fish study plan with possible changes in 1998. In 1996, FERC amended the license to implement amended minimum flow criteria and require fish monitoring studies for completion in 2005. In 2002, NMFS requested that FERC initiate formal consultation on the effects of the Don Pedro Project on Central Valley steelhead. The FERC approved the Summary Report on fisheries in 2008. In 2009, NMFS, USFWS, CDFW, and several environmental interest groups filed requests for rehearing on the license. FERC denied portions of the request but required instream flow studies to be conducted and required NMFS to be included for consultation on any authorized changes to minimum flow release schedules.

The FERC also directed the appointment of an administrative law judge to assist in assessing the need for and feasibility for interim measures prior to relicensing. A final report was completed in 2010. Following the completion of the report and a monitoring plan by the affected districts, FERC approved an order modifying and approving instream flow and monitoring study plans. The current license expires in 2016.

The objective of the relicensing process is to continue operation and maintenance of the Don Pedro Project facilities for electric power generation, along with implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license.

3.5.1.12 FERC Relicense Renewal for Merced Irrigation District's Merced River Hydroelectric Project

The Merced River Hydroelectric Project is located on the Merced River in Mariposa County and includes both Lake McClure and McSwain Reservoir, two powerhouses (New Exchequer and McSwain), and recreation facilities. The initial FERC license expires on February 28, 2014. The objective of the relicensing process is to continue operation and maintenance of the Merced River Hydroelectric Project facilities for electric power generation, along with implementation of any terms and conditions to be considered for inclusion in a new FERC hydroelectric license (Merced ID 2013).

3.5.1.13 Central Valley RWQCB Irrigated Lands Regulatory Program

The Irrigated Lands Regulatory Program regulates discharges from irrigated agricultural lands. Its purpose is to prevent agricultural discharges from impairing the waters that receive the discharges. The California Water Code authorizes the SWRCB and Regional Water Quality Control Boards to conditionally waive waste discharge requirements if this is in the public interest. On this basis, the Los Angeles, Central Coast, Central Valley, and San Diego regional water quality control boards have issued conditional waivers of waste discharge requirements to growers that contain conditions requiring water quality monitoring of receiving waters. In 2010, the Central Valley Regional Water Quality Control Board proposed to expand the requirements to groundwater especially for regulation of discharges with higher concentrations of nutrients (CVRWQCB 2011). Participation in the waiver program is voluntary; however, non-participant dischargers must file a permit application as an individual discharger, stop discharging, or apply for coverage by joining an established coalition group. The waivers must include corrective actions when impairments are found.

3.5.1.14 San Luis Reservoir Low Point Improvement Project

The San Luis Reservoir Low Point Improvement Project is proposed by Reclamation, the Santa Clara Valley Water District, and the San Luis and Delta Mendota Water Authority. As part of this project, Reclamation is investigating three alternatives to address the water quality problems within the CVP's San Felipe Division (Santa Clara and San Benito counties) that arise when San Luis Reservoir levels drop below 300,000 acre-feet during late summer in dry water years, resulting in large algal blooms. The alternatives being considered are to 1) expand the 6,000 acre-feet Pacheco Reservoir to 80,000 acre-feet or 130,000 acre-feet, 2) lower the San Felipe Intake at San Luis Reservoir, or 3) implement a combination comprehensive plan. The combination comprehensive plan would involve increasing groundwater recharge and recovery capacity, implementing desalination measures, re-operating Santa Clara Valley Water District's raw- and treated-water systems, and implementing institutional measures. If Pacheco Reservoir were to be enlarged, the reservoir would be filled with Delta water; thus, additional impacts on Delta aquatic species (e.g., juvenile salmonids and Delta Smelt) could result from an increase in Delta exports. The environmental scoping report for the San Luis Reservoir Low Point Improvement Project was released in January 2009 and the plan formulation report was published in January 2011 (Reclamation et al. 2011).

3.5.1.15 Future Water Supply Projects

Many of the future projects would directly increase regional and local water supplies through groundwater storage and recovery programs, improved conveyance that connects water supplies from different water agencies, recycled water projects, and desalination projects. Water resources projects that have been approved and are being implemented were previously described in this chapter under the No Action Alternative. The following major water supply projects are currently being evaluated and are considered under the Cumulative Effects analysis.

- Future Groundwater Storage and Recovery Projects
  - City of Roseville (City of Roseville 2012)
  - Mokelumne River Water & Power Authority (MORE 2015)
  - Northeastern San Joaquin County Groundwater Banking Authority (NSJCGBA 2011)
  - Stockton East Water District (SEWD 2012)
  - Madera Irrigation District (Reclamation 2011b)
  - Kings River Conservation District (KRCD 2012b)

- Buena Vista Water Storage District and Rosedale Rio Bravo Water Storage District (BVWSD 2015)
- City of Los Angeles (City of Los Angeles 2010, 2013b)
- Los Angeles County (Los Angeles County 2013b)
- City of San Diego (City of San Diego 2009a, 2009b)
- Rancho California Water District (RCWD 2011, 2012)
- Eastern Municipal Water District (EMWD 2014c)
- Jurupa Community Services District (JCSD et al. 2010)

- Major Conveyance Projects
  - Bay Area Regional Water Supply Reliability (CCWD 2014, EBMUD 2014)
  - Friant-Kern Canal and Madera Canal Capacity Restoration Projects (SJRRP 2011, 2015)
  - Los Banos Creek Water Resources Management Plan (SJRECWA 2012)
- Major Recycle Water Projects (more than 10,000 acre-feet/year)
  - City of Fresno (City of Fresno 2011)
  - City of Los Angeles (City of Los Angeles 2005)
  - Central Basin Municipal Water District (CBMWD 2010)
  - Foothill Municipal Water District (MWDSC 2010)
  - Upper San Gabriel Valley Municipal Water District (USGVMWD 2013)
  - West Basin Municipal Water District (WBMWD 2011, 2015a)
  - Olivenhain Municipal Water District (OMWD 2015)
  - Eastern Municipal Water District (EMWD 2014c)
  - Inland Empire Utilities Agency (IEUA 2014)
  - Palmdale Water District (PWD 2010)
  - East Valley Water Reclamation Authority (Antelope Valley 2013)
- Major Future Coastal Desalination Water Projects
  - San Francisco Bay Area Regional Desalination Project (BARDP 2015)
  - City of Santa Barbara (City of Santa Barbara 2015)
  - Camrosa Water District (CWD 2015)
  - City of Long Beach (City of Long Beach 2015)
  - City of Huntington Beach (City of Huntington Beach 2010)
  - City of Oceanside (City of Oceanside 2012)
  - City of Carlsbad (City of Carlsbad 2006)
  - West Basin Municipal Water District (WBMWD 2015b)
  - Metropolitan Water District of Orange County (MWDOC 2015)
  - San Diego County Water Authority in the Southern California Region (SDCWA 2009, 2015)

3.5.2 Ecosystem Improvement Projects and Actions

There are numerous ecosystem improvement projects and actions that could be potentially affected by changes in the coordinated long-term operation of the CVP and SWP, or could affect the CVP and SWP operations. Major future water supply and water quality projects and actions are discussed below.

3.5.2.1 Mill Creek Riparian Assessment

The need to restore and maintain riparian habitat in Mill Creek is identified in the Anadromous Fish Restoration Program and CALFED Bay-Delta Ecosystem Restoration Program goals, objectives, and targets. The AFRP is one of five CVPIA programs that have been integrated with the Ecosystem Restoration Plan. Both of these programs prioritize establishment, restoration, and maintenance of anadromous fish habitat on this stream, particularly in the arena of riparian habitat and flow enhancement. In response to this identified need, Reclamation and USFWS is implementing the Mill Creek Riparian Assessment. The project includes: 1) riparian habitat and condition mapping and vegetation classification of the Mill Creek watershed, 2) identifying and prioritizing areas that should be restored, enhanced, and/or preserved in addition to existing conservation easements, and 3) identifying the types of restoration actions that should occur at the prioritized sites (USFWS 2010).

3.5.2.2 Yolo County Habitat/Natural Community Conservation Plan

The Yolo County Habitat Joint Powers Authority, consisting of five local public agencies, launched the Yolo Natural Heritage Program in March 2007. This effort includes the continuing preparation of a joint Habitat Conservation Plan/ Natural Community Conservation Plan (HCP/NCCP). Member agencies include Yolo County and the cities of Davis, Woodland, West Sacramento, and Winters.

The HCP/NCCP describes the measures that local agencies will implement to conserve biological resources, obtain permits for urban growth and public infrastructure projects, and continue to maintain the agricultural heritage and productivity of Yolo County. The nearly 653,820-acre planning area provides habitat for covered species occurring within five dominant habitats/natural communities. The plan proposes to address 63 covered species, including seven state-listed species: palmate-bracted bird's-beak, Colusa grass, Crampton's tuctoria, giant garter snake, Swainson's hawk, western yellow-billed cuckoo, and bank swallow. Interim conservation activities include acquiring permanent conservation easements for sensitive species habitat in the plan area (YNHP 2015).

3.5.2.3 North Delta Flood Control and Ecosystem Restoration Project

The North Delta Flood Control and Ecosystem Restoration Project is proposed near the confluence of the Cosumnes and Mokelumne rivers by the DWR and encompasses approximately 197 square miles. Consistent with objectives contained in the CALFED Record of Decision, the project is intended to improve flood management and provide ecosystem benefits in the North Delta area through actions such as construction of setback levees and configuration of flood bypass areas to create quality habitat for species of concern. These actions are focused on McCormack-Williamson Tract and Staten Island. The project would implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. Flood control improvements are needed to reduce damage to land uses, infrastructure, and the Bay-Delta ecosystem resulting from overflows caused by insufficient channel capacities and catastrophic levee failures in the 197 square-mile project study area. The proposed project as described in the Final EIR (DWR 2010b) included: portions of the levee system degraded to allow controlled flow across McCormack-Williamson Tract; levee modification to mitigate hydraulic impacts; channel dredging to increase flood conveyance capacity; an off-channel detention basin on Staten Island; ecosystem restoration where floodplain forests and marshes would be developed at McCormack-Williamson Tract and the Grizzly Slough property; setback levee on Staten Island to expand the floodway conveyance; and opening up the southern portion of McCormack-Williamson Tract to boating; improving Delta Meadows property; providing access and interpretive kiosks for wildlife viewing; and providing restroom, circulation, parking, and signage infrastructure to support such uses.

3.5.2.4 Franks Tract Project

Reclamation is conducting studies to evaluate the feasibility of modifying the hydrodynamic conditions near Franks Tract to improve Delta water quality and enhance the aquatic ecosystem. The results of these studies have indicated that modifying the hydrodynamic conditions near Franks Tract may substantially reduce salinity in the Delta and protect fishery resources, including populations of Delta Smelt. Reclamation IS evaluating installing operable gates to control the flow of water at key locations (Threemile Slough and/or West False River) to reduce sea water intrusion, and to positively influence movement of fish species of concern to areas that provide favorable habitat conditions. The project gates would be operated seasonally and during certain hours of the day, depending on fisheries and tidal conditions. Boat passage facilities would be included to allow for passing of watercraft when the gates are in operation. The Franks Tract Project is consistent with ongoing planning efforts for the Delta to help balance competing uses and create a more sustainable system for the future. By protecting fish resources, this project also could improve operational reliability of the CVP and SWP because curtailments in water exports (pumping restrictions) are likely to be less frequent. Franks Tract was previously evaluated as part of DWR's Flooded Island Pre-Feasibility Study Report (DWR 2007).

3.6 Summary of Environmental Consequences

Conditions in 2030 related to environmental and human resources that would occur with implementation of the No Action Alternative was compared to conditions under the Second Basis of Comparison; and conditions under Alternatives 1 through 5 were compared to the conditions of implementation of under the No Action Alternative and the Second Basis of Comparison, as described in Chapter 4, Approach to Environmental Analysis. The results of these analyses are described in Chapters 5 through 21 of this EIS and summarized in Tables 3.6 and 3.7.

Table 3.6 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
Surface Water Resources and Water Supplies		
Alternative 1	**Trinity Lake** In wet years and dry years, storage would be similar in all months. In above normal years, storage would be similar in January through October; and increased in November and December (up to 6.0 percent). In below normal years, storage would be similar in January through October; and increased in November and December (up to 5.2 percent). In critical dry years, storage would be increased in all months (up to 11.5 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions, flows would be similar in March through November; and increased in December through February (up to 10.5 percent). In wet years, flows would be similar in April through November; and increased in December through March (up to 12.6 percent). In dry years, flows would be similar all months. **Shasta Lake** In wet years, storage would be similar in December through August and October; and increased in September and November (up to 8.9 percent). In above normal years, storage would be similar in January through September; and increased in October through December (up to 8.1 percent). In below normal years, storage would be similar in March through September; and increased in October through February (up to 11.7 percent). In dry years, storage would be similar in February through October; and increased in November through January (up to 6.5 percent). In critical dry years, storage would be increased under all months (up to 16.8 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; reduced flows in September and November (up to 27.4 percent); and increased flows in December, January, and June (up to 8.4 percent). In wet years, similar flows would occur in January through July; reduced flows in September through November (up to 43.7 percent); and increased flows in December and August (up to 17.0 percent). In dry years, similar flows would occur in July through October, December through March, and May; reduced flows in November (25.0 percent); and increased flows in April and June (up to 7.8 percent).	Environmental effects associated with changes in the following physical conditions are related to impacts on biological resources (as described in Chapter 9, Fish and Aquatic Resources, and Chapter 10, Terrestrial Biological Resources), and recreation resources (as described in Chapter 15, Recreation Resources): 1) Reductions in Sacramento River fall flows. 2) Reductions in Feather River summer flows. 3) Reductions in American River late summer flows. 4) Reductions in Clear Creek spring flows. 5) Reductions in Stanislaus River spring, summer, and fall flows. 6) Reductions San Joaquin River fall flows. 7) Reductions in Delta outflow in late spring, summer, and fall. 8) Increased negative OMR flows in fall, winter, and spring. Mitigation measures, if needed, related to environmental changes caused by changes in surface water conditions are presented in Chapters 9, 10, and 15.

Alternative	Potential Change	Consideration for Mitigation Measures
	Sacramento River at Freeport Over long-term conditions, similar flows would occur in October, December through May, and August; reduced flows in September, November, and July (up to 30.2 percent); and increased flows in June (12.8 percent). In wet years, similar flows would occur in January through June and October; reduced flows in July through September and November (up to 47.4 percent); and increased flows in December (6.6 percent). In dry years, similar flows would occur in August through October and December through April; reduced flows in November and July (up to 13.6 percent); and increased flows in May and June (up to 13.5 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 21.8 percent). In above normal years, storage would be similar in February through August; and reduced in September through January (up to 15.2 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 21.5 percent). In dry years, storage would be similar in June; and reduced in all other months (up to 14.2 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and April; reduced flows in July through September (up to 43.2 percent); and increased flows in October, December through March, May, and June (up to 37.4 percent). In wet years, similar flows would occur in October, November, and March through May; reduced flows in July through September (up to 64.9 percent); and increased flows in December through February and June (up to 35.1 percent). In dry years, similar flows would occur in December through April; reduced flows in July (34.4 percent); and increased flows in August through October, May, and June (up to 38.1 percent). **Folsom Lake** In wet years, storage would be similar in December through August; and increased in September through December (up to 12.1 percent). In above normal years, storage would be similar in January through July and September through October; increased in November and December (up to 8.9 percent); and reduced in August (5.4 percent). In below normal years, storage would be similar in February through May; reduced in June through September (up to 14.6 percent); and increased in October through January (up to 13.5 percent). In dry years, storage would be similar in all months.	

Alternative	Potential Change	Consideration for Mitigation Measures
	In critical dry years, storage would be similar in October through June; and increased in July through September (up to 12.1 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November through May and July; reduced flows in September and October (up to 30.9 percent); and increased flows in June (5.4 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in September (47.7 percent); and increased flows in August (12.0 percent). In dry years, similar flows would occur in November through January, March through June, August, and September; reduced flows in October (14.1 percent); and increased flows in February and July (up to 7.9 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and reduced in May (40.7 percent). **New Melones Reservoir** In wet years, storage would be similar in all months. In above normal years, storage would be similar in December through September; and increased in October and November (up to 6.0 percent). In below normal years, storage would be similar in November through September; and increased in October (5.4 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in July through September; and increased in October through June (up to 7.5 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, similar flows would occur in July through September; reduced flows in October, March, and April (up to 59.8 percent); and increased flows in November through February and June (up to 51.1 percent). In wet years, similar flows would occur in February and April; reduced flows in October, March, May, July, and August (up to 53.9 percent); and increased flows in September, November through January, and June (up to 103.2 percent). In dry years, similar flows would occur in July through September; reduced flows in October and April (up to 60.7 percent); and increased flows in November through March, May, and June (up to 55.5 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in July through September and November through May; reduced flows in October (16.1 percent); and increased flows in June (8.4 percent). In wet years, similar flows would occur in July through September and November through May; reduced flows in October (14.4 percent); and	

Alternative	Potential Change	Consideration for Mitigation Measures
	increased flows in June (10.4 percent). In dry years, similar flows would occur in November through March and May through September; and reduced flows in October and April (up to 15.3 percent). **San Luis Reservoir** In wet years, storage would be increased in all months (up to 108.8 percent). Water storage elevations would be increased in all months (up to 12.0 percent). In above normal years, storage would be increased in all months (up to 151.4 percent). Water storage elevations would be increased in all months (up to 15.0 percent). In below normal years, storage would be increased in all months (up to 203.1 percent). Water storage elevations would be increased in all months (up to 19.0 percent). In dry years, storage would be increased in all months (up to 70.3 percent). Water storage elevations would be increased in all months (up to 11.6 percent). In critical dry years, storage would be increased in all months (up to 57.1 percent). Water storage elevations would be increased in all months (up to 10.8 percent). **Yolo Bypass** In wet years, flows into Yolo Bypass would be similar in January through September; reduced in October (20 percent); and increased in November and December (up to 17.4 percent). In above normal years, flows into Yolo Bypass would be similar in April through December; and increased in January through March (up to 16.2 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and increased in December through March (up to 33.9 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and increased in December (6.2 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in December, February, March, and June (up to 1,492 cfs); and decrease in July through November, January, April, and May (up to 13,683 cfs). In dry years, average monthly Delta outflow would be similar in September; decrease in July, August, and October through May (up to 3,114 cfs); and increase in June (385 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows, would be more positive in June through August and March (up to 923 cfs); and more negative in April through June and September through February (up to 10,005 cfs). In dry years, average monthly OMR flows would be positive in July (up to 2,073 cfs), and more negative in August through June (up to 3,489 cfs).	

Alternative	Potential Change	Consideration for Mitigation Measures
	CVP and SWP Exports and Deliveries Long-term average annual exports would be 1,051 TAF (22 percent) more under Alternative 1 as compared to the No Action Alternative. Deliveries to CVP North of Delta agricultural water service contractors would be increased by 19 percent over the long-term conditions; 45 percent in dry years; and 59 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be increased by 7 percent over the long-term conditions; 9 percent in dry years; and 8 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be increased by 31 percent over the long-term conditions; 49 percent in dry years; and 60 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be increased by 11 percent over the long-term conditions; 10 percent in dry years; and 7 percent in critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and in dry and critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be increased by 22 percent over the long-term conditions; 22 percent in dry years; and 25 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be increased by 22 percent over the long-term conditions; 24 percent in dry years; and 28 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be reduced by 9 percent over the long-term conditions; 6 percent in dry years; and 9 percent in critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be increased by 504 percent over the long-term conditions; 2,265 percent in dry years; and 1,219 percent in critical dry years.	
Alternative 2	No effects on surface water resources or water supplies.	None needed
Alternative 3	**Trinity Lake** In wet, above normal years, below normal, and dry years, storage would be similar in all months. In critical dry years, storage would be increased in all months (up to 11.9 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions, flows would be similar in March through November; and increased in December through February (up to 11.8 percent). In wet years, flows would be similar in April through October; reduced in November (7.0 percent); and increased in December through March (up to 15.1 percent). In dry years, flows would be similar in all months.	Environmental effects associated with changes in the following physical conditions are related to impacts on biological resources (as described in Chapter 9, Fish and Aquatic Resources, and Chapter 10, Terrestrial Biological Resources), and recreation resources (as described in Chapter 15, Recreation Resources): 1) Reductions in Trinity River fall flows. 2) Reductions in Sacramento River late summer and fall flows.

Alternative	Potential Change	Consideration for Mitigation Measures
	Shasta Lake In wet years, storage would be similar in December through August; and increased in September and November (up to 8.7 percent). In above normal years, storage would be similar in January through October; and increased in November and December (up to 7.1 percent). In below normal years, storage would be similar in March through September; and increased in October through February (up to 11.9 percent). In dry years, storage would be similar in March through October; and increased in November through January (up to 7.4 percent). In critical dry years, storage would increase in all months (up to 12.2 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; reduced flows in September and November (up to 20.1 percent); and increased flows in December, January, and June (up to 8.9 percent). In wet years, similar flows would occur in February through August; reduced flows in September through November (up to 42.1 percent); and increased flows in December and January (up to 16.9 percent). In dry years, similar flows would occur in July through September and December through May; reduced flows in November (24.6 percent); and increased flows in January and June (up to 7.3 percent). **Sacramento River at Freeport** Over long-term conditions, similar flows would occur in October, December through May, July, and August; reduced flows in September and November (up to 30.1 percent); and increased flows in June (12.1 percent). In wet years, similar flows would occur in January through May, July, and October; reduced flows in August, September, and November (up to 48.1 percent); and increased flows in December and June (up to 6.6 percent). In dry years, similar flows would occur in July through October and December through April; reduced flows in November (14.2 percent); and increased flows in May and June (up to 15.7 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and increased in September through December (up to 18.5 percent). In above normal years, storage would be similar in February through August; and increased in September through January (up to 18.5 percent). In below normal years, storage would be similar in June through September; and increased in October through May (up to 22.5 percent). In dry years, storage would be similar in May through September; and increased in October	3) Reductions in Feather River late summer and fall flows. 4) Reductions in American River fall flows. 5) Reductions in Clear Creek spring flows. 6) Reductions in Stanislaus River spring, summer, and fall flows. 7) Reductions San Joaquin River fall and spring flows. 8) Reductions in Delta outflow in spring, summer, and fall. 9) Increased negative OMR flows in fall and winter. Mitigation measures, if needed, related to environmental changes caused by changes in surface water conditions are presented in Chapters 9, 10, and 15.

Alternative	Potential Change	Consideration for Mitigation Measures
	through April (up to 12.3 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in October, November, March, April, and July; reduced flows in August and September (up to 49.4 percent); and increased flows in December through February, May, and June (up to 33.9 percent). In wet years, similar flows would occur in October, November, February through May, and July; reduced flows in August and September (up to 70.0 percent) and increased flows in December, January, and June (up to 28.1 percent). In dry years, similar flows would occur in September and January through April; reduced flows in October through December and July (up to 14.5 percent); and increased flows in May, June, and August (36.9 percent). **Folsom Lake** In wet years, storage would be similar in December through August; and increased in September through December (up to 12.1 percent). In above normal years, storage would be similar in January through June, September, and October; and increased in November and December (up to 6.3 percent); and reduced in July and August (up to 6.7 percent). In below normal years, storage would be similar in February through July; reduced in August and September (up to 10.0 percent); and increased in October through January (up to 15.0 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in October through July; and increased in August and September (up to 11.6 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November, January through May, July, and August; reduced flows in September and October (up to 28.7 percent); and increased flows in June (5.8 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in September (45.9 percent); and increased flows in August and December (up to 8.5 percent). In dry years, similar flows would occur in November through January and March through September; reduced flows in October (11.2 percent); and increased flows in February (6.1 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and reduced in May (28.9 percent). **New Melones Reservoir**	

Alternative	Potential Change	Consideration for Mitigation Measures
	In wet years, storage would be increased in all months (up to 13.3 percent). In above normal years, storage would be increased in all months (up to 23.3 percent). In below normal years, storage would be increased in all months (up to 19.8 percent). In dry years, storage would be increased in all months (up to 25.3 percent). In critical dry years, storage would be increased in all months (up to 37.8 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, reduced flows would occur in October and March through June (up to 58.3 percent); and increased flows in November through February and July through September (up to 36.81 percent). In wet years, similar flows would occur in April; reduced flows in October, March, and May (up to 52.9 percent); and increased flows in June through September and November through February (up to 67.8 percent). In dry years, similar flows would occur in March and July through September; reduced flows in October and April through June (up to 59.6 percent); and increased flows in November through February (up to 37.0 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in November through September; and reduced flows in October (15.7 percent). In wet years, similar flows would occur in November through August; reduced flows in October (14.1 percent); and increased flows in September (5.7 percent). In dry years, similar flows would occur in November through March and July through September; and reduced flows in October and April through June (up to 15.2 percent). **San Luis Reservoir** In wet years, storage would be increased in all months (up to 96.3 percent). Water storage elevations would be increased in all months (up to 13.0 percent). In above normal years, storage would be increased in all months (up to 111.4 percent). Water storage elevations would be similar in October through March; and increased in April through September (up to 11.3 percent). In below normal years, storage would be increased in all months (up to 106.9 percent). Water storage elevations would be similar in September; and increased in October through August (up to 10.7 percent). In dry years, storage would be similar in September; and increased in October through August (up to 52.1 percent). Water storage elevations would be similar December through May and July through October; and increased in November and June (up to 6.8 percent).	

Alternative	Potential Change	Consideration for Mitigation Measures
	In critical dry years, storage would be similar in February through May; and increased in June through January (up to 29.2 percent). Water storage elevations would be similar in all months. **Yolo Bypass** In wet years, flows into Yolo Bypass would be similar in January through September; reduced in October (24.5 percent); and increased in November and December (up to 15.1 percent). In above normal years, storage would be similar in April through January; and increased in February and March (up to 11.7 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and increased in December through March (up to 32.0 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and increased in December (6.0 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in December through March (up to 3,307 cfs); and decrease in April through November (up to 13,678 cfs). In dry years, average monthly Delta outflow would increase January, February, June, and July (up to 277 cfs); and decrease in August through December and March through May (up to 2,902 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows would be more positive in July and August (up to 800 cfs); and more negative in September through June (up to 4,477 cfs). In dry years, average monthly OMR flows would be more positive in July and January (up to 728 cfs), and more negative in August through December and February through June (up to 1,847 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 726 TAF (15 percent) more under Alternative 3 as compared to the No Action Alternative. Deliveries to CVP North of Delta agricultural water service contractors would be increased by 13 percent over the long-term conditions; 30 percent in dry and critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be similar over the long-term conditions and critical dry years; and increased deliveries by 7 percent in dry years. Deliveries to CVP South of Delta agricultural water service contractors would be increased by 28 percent over the long-term conditions; 34 percent in dry years; and 28 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar in critical dry years; and increased by 9 percent over the long-term conditions and 8 percent in dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years;	

Alternative	Potential Change	Consideration for Mitigation Measures
	and increased by 15 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be increased by 17 percent over the long-term conditions and in dry years; and 13 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be increased by 17 percent over the long-term conditions and in dry years; and 14 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be increased by 128 percent over the long-term conditions; 384 percent in dry years; and 214 percent in critical dry years.	
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	See Alternative 1 compared to the No Action Alternative.
Alternative 5	**Trinity Lake** Similar storage and surface water elevations in all months and all water year types. **Trinity River downstream of Lewiston Dam** Similar flows in all months for long-term conditions and wet and dry years. **Shasta Lake** Similar storage and surface water elevations in all months and all water year types. **Sacramento River at Keswick** Similar flows in all months for long-term conditions and wet and dry years. **Sacramento River at Freeport** Similar flows in all months for long-term conditions and wet and dry years. **Lake Oroville** Similar storage and surface water elevations in all months and all water year types. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in June through April; and reduced flows in May (6.6 percent). In wet years, similar flows would occur in all months. In dry years, similar flows would occur in September through April and June; reduced flows in May (27.1 percent); and increased flows in July and August (up to 8.9 percent). **Folsom Lake** Similar storage and surface water elevations in all months and all water year types. **American River downstream of Nimbus Dam** Similar flows in all months for long-term conditions and wet and dry years. **Clear Creek downstream of Whiskeytown Dam** Flows would be identical in all months. **New Melones Reservoir** In wet years, storage would be similar in all months.	To mitigate reductions of up to 7 percent in critical dry years to the Eastside Contractors would, Reclamation would coordinate with all water users of water from the Stanislaus River in an attempt to minimize adverse impacts. Environmental effects associated with changes in the following physical conditions are related to impacts on biological resources (as described in Chapter 9, Fish and Aquatic Resources, and Chapter 10, Terrestrial Biological Resources), and recreation resources (as described in Chapter 15, Recreation Resources): 1) Reductions in Feather River spring flows. 2) Reductions in Stanislaus River spring and summer flows. 3) Increased negative OMR flows in winter, spring and summer. Mitigation measures, if needed, related to environmental changes caused by changes in surface water conditions are presented in Chapters 9, 10, and 15.

Alternative	Potential Change	Consideration for Mitigation Measures
	In above normal years, storage would be similar in October through June; and reduced in July through September (up to 5.7 percent). In below normal years, storage would be reduced in all months (up to 9.2 percent). In dry years, storage would be reduced in all months (up to 10.2 percent). In critical dry years, storage would be reduced in all months (up to 18.9 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, flows would be similar in September through February and June; reduced flows would occur in March, July, and August (up to 8.0 percent); and increased flows in April and May (up to 22.4 percent). In wet years, similar flows would occur in October, November, January, February, and April through June; reduced flows in December, March, and July through September (up to 18.0 percent). In dry years, similar flows would occur in June through March; and increased flows in April and May (up to 47.3 percent). **San Joaquin River at Vernalis** Over long-term conditions and wet years, similar flows would occur in all months. In dry years, similar flows would occur in June through March; and increased flows in April and May (up to 15.7 percent).San Luis Reservoir **San Luis Reservoir** In wet years, storage would be similar in January through May; and increased in June through December (up to 10.0 percent). In above normal years, storage would be similar in all months. In below normal years, storage would be similar in November, February through April, August, and September; reduced in June and July (up to 9.2 percent); and increased in October, December, January, and May (up to 8.3 percent). In dry years, storage would be similar in October through March; and reduced in April through September (up to 17.3 percent). In critical dry years, storage would be similar in February and March; and reduced in April through January (up to 18.2 percent). Surface water elevations would be similar in all months, in all water years. **Yolo Bypass** Similar flows into the Yolo Bypass in all months and all water year types. **Delta Outflow** In wet years, average monthly Delta outflow would be similar. In dry years, average monthly Delta outflow would be similar in July through April; and increased in May and June (up to 1,377 cfs). **Reverse Flows in Old and Middle Rivers**	

Alternative	Potential Change	Consideration for Mitigation Measures
	In wet years, OMR flows would be more positive or no change in September, October, January, and April through June (up to 171 cfs); and more negative in November, December, March, and August (up to 124 cfs). In dry years, OMR flows would be more positive or no change in October through March (up to 1,359 cfs); and more negative in June through September (up to 568 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 45 TAF (1 percent) less under Alternative 5 as compared to the No Action Alternative. Deliveries to CVP North of Delta agricultural water service contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar over the long-term conditions and in dry and critical dry years in total and for the American River CVP contractors. Deliveries to CVP South of Delta agricultural water service contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and reduced by 7.7 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 8 percent over the long-term conditions and 41 percent in critical dry years; and increased by 12 percent in dry years.	
	Surface Water Quality	
Alternative 1	Salinity increases near Emmaton in June (5 to 41 percent depending upon water year type); decreases in July through March (5 to 79 percent); and is similar in April and May. Salinity increases near CVP and SWP, Contra Costa Water District, and Antioch (5 to over 47 percent) in February through August; and is similar or decreases (5 to over 39 percent) in September through January. Salinity decreases near Port Chicago in September through May (5 to 33 percent); and is similar in June through August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term	Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce salinity near the CVP, SWP, Contra Costa Water District, and Antioch intakes and near Emmaton.

Alternative	Potential Change	Consideration for Mitigation Measures
	conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	
Alternative 2	No effects on public health issues.	None needed
Alternative 3	Salinity decreases near Emmaton in September through January (5 to 68 percent); and is similar in February through August. Salinity increases CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 50 percent) in February through June; and is similar or decreases (5 to over 30 percent) in July through January. Salinity decreases near Port Chicago in September through June (5 to 34 percent); and is similar in July and August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce salinity near the CVP, SWP, Contra Costa Water District, and Antioch intakes.
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	Salinity near Emmaton is similar in all months. Salinity decreases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 29 percent) in April through June; and is similar in July through February. Salinity near Port Chicago is similar in all months. Similar mercury concentrations in Largemouth Bass throughout the Delta. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	None needed
	Groundwater Resources	
Alternative 1	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Region** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would decrease by approximately 8 percent. July groundwater levels in all water year types would be higher by approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 500 feet in the Westside subbasin. The higher groundwater levels would reduce the potential for land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Increases in CVP and SWP water supplies, could decrease groundwater pumping and decrease the potential for land subsidence.	None needed
Alternative 2	No effects on groundwater resources or water supplies.	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 3	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Region** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would decrease by approximately 6 percent. July groundwater levels in all water year types would be higher by approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 500 feet in the Westside subbasin. The higher groundwater levels would reduce the potential for land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Increases in CVP and SWP water supplies, could decrease groundwater pumping and decrease the potential for land subsidence.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping, levels, and quality in the San Joaquin Valley would be similar. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; and 25 to 50 feet in the Westside subbasin. **San Francisco Bay Area, Central Coast, and Southern California Regions** Because the CVP and SWP water deliveries would be similar; groundwater pumping would be similar the potential for land subsidence would be similar.	None needed
Energy Resources		
Alternative 1	CVP annual net generation would be similar. SWP annual net generation would be increased by 41 percent over the long-term condition; and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.	None needed
Alternative 2	No effects on energy resources.	None needed
Alternative 3	CVP annual net generation would be similar. SWP annual net generation would be increased by 27 percent over the long-term condition; and by 16 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	CVP and SWP annual net generation would be similar. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to be similar.	None needed
	Fish and Aquatic Resources	
Alternative 1	**Trinity River Region** Coho Salmon Overall, the temperature model outputs for each of the Coho Salmon life stages suggest that the temperature of water released at Lewiston Dam generally would be similar under both scenarios, although the exceedance of water temperature thresholds would be slightly less frequent (1 percent). The higher water temperatures in November of critical dry years (and lower temperatures in December) would likely have little effect on Coho Salmon as water temperatures in the Trinity River are typically low during this time period. Given the similarity of the results and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), likely to result in similar effects. Spring-run Chinook Salmon Although the water temperatures could adversely affect spring-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences water temperatures as compared to the No Action Alternative. Overall, is likely to result in similar effects. Fall-run Chinook Salmon Water temperature changes, not likely have adverse effects because changes would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. Steelhead Water temperature changes would not likely have adverse effects because these changes would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Overall, likely to have similar effects. Green Sturgeon Overall, given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. Reservoir Fishes Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar. Pacific Lamprey On average, the temperature of water released at Lewiston Dam generally would be similar. Given the similarities in temperature, it is likely that the effects	Implement fish passage programs at Shasta, Folsom, and New Melones dams to reduce temperature impacts on Chinook Salmon and steelhead. Coordination of CVP and SWP operations with USFWS and NMFS to reduce impacts on late fall-run Chinook Salmon, Delta Smelt, Longfin Smelt, and Reservoir Fishes on the Sacramento River System.

Alternative	Potential Change	Consideration for Mitigation Measures
	on Pacific Lamprey would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon Given that the highest increases in flow under would be less than 10 percent in the Trinity River with a smaller relative change in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River are unlikely to be affected by changes upstream at Lewiston Dam, is the changes are likely to have a similar effect to influence Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon Effects on winter-run Chinook Salmon would be similar, with a small likelihood that winter-run Chinook Salmon escapement would be lower. This potential distinction may become more adverse due to the lack of fish passage. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. This potential distinction may become more adverse by the lack of without fish passage. Late Fall-run Chinook Salmon The output from SALMOD indicated that late fall-run Chinook Salmon production would be similar, although production could be slightly lower in some water year types and about 4 percent higher in critical dry years. The analyses attempting to assess the effects on routing, entrainment, and salvage of juvenile salmonids in the Delta suggest that salvage (as an indicator of potential losses of juvenile salmon at the export facilities) of Sacramento River-origin Chinook Salmon is predicted to be higher in every month. Although survival in the Delta may be lower, given the similarity in the SALMOD outputs, it is likely that the effects on fall-run Chinook Salmon would be similar. Effects may become more adverse due to the lack of without fish passage. Steelhead The model results suggest that overall, effects on steelhead could be slightly less adverse, particularly in the Feather River. This potential distinction may become more adverse due to the lack of fish passage. Green Sturgeon The temperature model outputs for the Sacramento and Feather rivers suggest that thermal conditions	

Alternative	Potential Change	Consideration for Mitigation Measures
	and effects on Green Sturgeon in the Sacramento and Feather rivers generally would be slightly less adverse. This conclusion is supported by the water temperature threshold exceedance analysis that indicated that the water temperature thresholds for Green Sturgeon spawning, incubation, and rearing would be exceeded less frequently under Alternative 1 in the Sacramento River. The water temperature threshold for Green Sturgeon spawning, incubation, and rearing would also be exceeded less frequently during some months in the Feather River, but would be exceeded more frequently in September. Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the reduced frequency of exceedance of temperature thresholds could benefit Green Sturgeon in the Sacramento and Feather rivers. White Sturgeon Overall, the temperature model outputs suggest that thermal conditions and effects on White Sturgeon in the Sacramento River generally would be slightly less adverse. This conclusion is supported by the water temperature threshold exceedance analysis that indicated that the water temperature thresholds for White Sturgeon spawning, incubation, and rearing would be exceeded less frequently in the Sacramento River. Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the reduced frequency of exceedance of temperature thresholds could benefit White Sturgeon in the Sacramento River. Delta Smelt Overall, Alt likely would result in increased adverse effects on Delta Smelt primarily due to the potential for increased percentage entrainment during larval and juvenile life stages, and less favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the increase in frequency and magnitude of negative OMR flows and the lower Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be greater. Sacramento Splittail Slight increase in spawning habitat for Sacramento Splittail as a result of the increased area of potential habitat (inundation) and the potential for a slight increase in the frequency of inundation. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar to or slightly lower. This suggests that conditions in the reservoirs would be less likely to support self-sustaining populations of black bass. Pacific Lamprey Based on the somewhat increased flows and reduced temperatures during their spawning and	

Alternative	Potential Change	Consideration for Mitigation Measures
	incubation period, it likely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers would not differ in a biologically meaningful manner. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). <u>Striped Bass, American Shad, and Hardhead</u> In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly increased flows and decreased temperatures during their spawning and incubation period, it is likely that conditions for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would not differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** <u>Fall-run Chinook Salmon</u> Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. This potential distinction may become more adverse due to the lack of fish passage. <u>Steelhead</u> Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the differences in the magnitude and frequency of exceedance of suitable temperatures for the various lifestages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. This potential distinction may become more adverse due to lack of fish passage. <u>White Sturgeon</u> While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon between alternatives. <u>Reservoir Fishes</u> Overall, predicted nest survival is generally above 40 percent in all months evaluated, although survival would vary among months. Given the relatively high survival in general and the uncertainty caused by the inconsistency in changes in survival, it is likely that effects would be similar under both alternatives.	

Alternative	Potential Change	Consideration for Mitigation Measures
	Other Species In general, lamprey species can tolerate higher temperatures than salmonids, up to around 72 °F during their entire life history. Because lamprey ammocoetes remain in the river for several years, any substantial flow reductions or temperature increases could adversely affect these larval lamprey. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect lamprey species in the Stanislaus and San Joaquin rivers would be similar. In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** Killer Whale Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.	
Alternative 2	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon Similar effects. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects may become more adverse due to the lack of fish passage. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, Striped Bass, American Shad, and Hardhead Similar effects **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The effects may become more adverse due to the lack of fish passage. White Sturgeon, Reservoir Fishes, and Other Species Similar effects. **Pacific Ocean** Killer Whale Similar effects.	Implement fish passage programs at Shasta, Folsom, and New Melones dams to reduce temperature impacts on Chinook Salmon and steelhead.
Alternative 3	**Trinity River Region** Coho Salmon and Spring-run Chinook Salmon Although the water temperature and flow changes could have slight beneficial effects, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures.	Implement fish passage programs at Shasta, Folsom, and New Melones dams to reduce temperature impacts on Chinook Salmon and steelhead. Coordination of CVP and SWP

Alternative	Potential Change	Consideration for Mitigation Measures
	Overall, likely to result in similar effects on the spring-run Chinook Salmon population in the Trinity River. <u>Fall-run-run Chinook Salmon</u> Although the water temperature and flow changes suggest a lower potential for adverse effects on fall-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. <u>Steelhead</u> Although water temperatures suggest a slightly lower potential for adverse effects on steelhead in the Trinity River, the relatively small differences in flows and water temperatures under would likely result in similar effects on the steelhead population. <u>Green Sturgeon</u> Given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. <u>Reservoir Fishes</u> Overall, while reservoir storage and nest survival would be slightly higher, it is uncertain whether these differences would be biologically meaningful. Thus, it is likely that effects on black bass would be similar. <u>Pacific Lamprey</u> Overall, it is likely that effects on Pacific Lamprey would be similar. This conclusion likely also applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). <u>Eulachon</u> Given that the highest increases in flow would be less than 10 percent in the Trinity River, with a smaller relative increase in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River would unlikely to be affected by changes upstream at Lewiston Dam, it is likely that effects would have a similar potential to influence Eulachon in the Klamath River. **Sacramento River System** <u>Winter-run Chinook Salmon</u> Potentially more adverse due to lack of fish passage, The predator control measures could reduce winter-run Chinook Salmon mortality. <u>Spring-run Chinook Salmon</u> The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly less adverse with a small likelihood that spring-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce spring-run Chinook Salmon mortality. Overall, given the small differences between	operations with USFWS and NMFS to reduce impacts on late fall-run Chinook Salmon, Delta Smelt, Longfin Smelt, and Reservoir Fishes on the Sacramento River System; and Striped Bass and Hardhead on the Stanislaus and San Joaquin rivers.

Alternative	Potential Change	Consideration for Mitigation Measures
	Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. <u>Fall-run-run Chinook Salmon</u> The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce fall-run Chinook Salmon mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. <u>Late Fall-run-run Chinook Salmon</u> It is likely that the effects on late fall-run Chinook Salmon would be similar. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce late fall-run Chinook Salmon mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. <u>Steelhead</u> The model results suggest that overall, effects on steelhead could be slightly less adverse, particularly in the Feather River. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce steelhead mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. <u>Green Sturgeon</u> Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the	

Alternative	Potential Change	Consideration for Mitigation Measures
	effects likely would be similar. White Sturgeon Given the general similarity in results and the inherent uncertainty associated with the resolution of the temperature model, the effects likely would be similar. Delta Smelt Overall, likely would result in adverse effects, primarily due to increased percentage entrainment during larval and juvenile life stages, and less favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the increase in frequency and magnitude of negative OMR flows and the lower Longfin Smelt abundance index values, potential adverse effects likely would be greater. Sacramento Splittail Flows entering the Yolo Bypass generally would be somewhat higher, especially during below normal years in December through March. These increases would occur during periods of relatively low flow in the bypass, and could slightly increase the frequency of potential inundation. This could provide somewhat greater value to Sacramento Splittail because of the increased area of potential habitat (inundation) and the potential for a slight increase in the frequency of inundation. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar to or slightly lower. This suggests that conditions in the reservoirs could be less likely to support self-sustaining populations of black bass. However, it is uncertain whether this effect would be biologically meaningful. Thus, it is likely that effects on black bass would be similar. Pacific Lamprey Pacific Lamprey would be subjected to the same temperature conditions described above for salmonids. Based on the somewhat increased flows and slightly decreased temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a slightly lower potential to adversely affect Pacific Lamprey in the Sacramento, Feather, and American rivers. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). Other Species Changes in average monthly water temperature would be small. In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Given the somewhat increased flows and decreased water temperatures during their spawning and incubation period, it is likely to have a lower potential to adversely affect Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers. Predation controls related to Striped Bass would result in adverse effects.	

Alternative	Potential Change	Consideration for Mitigation Measures
	Stanislaus River/Lower San Joaquin River Fall-run-run Chinook Salmon Overall, likely would have slightly beneficial effects on the fall-run Chinook Salmon population in the San Joaquin River watershed. Beneficial effects to juvenile fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions under would benefit fall-run Chinook Salmon. Steelhead Given the frequency of exceedance under both Alternative 3 and the No Action Alternative, water temperature conditions for steelhead in the Stanislaus River would be generally stressful in the fall, late spring, and summer months. The differences in temperature exceedance (both positive and negative) would be relatively small, with no clear benefit. However, because Alternative 3 generally would exceed thresholds less frequently during the warmest months, slightly improved conditions. This potential distinction may become more adverse due to the lack of fish passage. Additional beneficial effects to juvenile steelhead as a result of trap and haul passage across through the Delta. It remains uncertain, however, if predator management actions would benefit steelhead. White Sturgeon While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon. Reservoir Fishes While the analyses suggest that the effects could be more adverse, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. Other Species In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the slightly lower flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be somewhat more adverse. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of	

Alternative	Potential Change	Consideration for Mitigation Measures
	killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.	
Alternative 4	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon The effects are identical as described under Alternative 1 as compared to the No Action Alternative. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, American Shad, and Hardhead The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Striped Bass The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The effects in the Stanislaus River/Lower San Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. White Sturgeon, Reservoir Fishes, and Other Species The effects in the Stanislaus River/Lower San Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Striped Bass The effects in the Stanislaus River/Lower San	Implement fish passage programs at Shasta, Folsom, and New Melones dams to reduce temperature impacts on Chinook Salmon and steelhead. Coordination of CVP and SWP operations with USFWS and NMFS to reduce impacts on late fall-run Chinook Salmon, Delta Smelt, Longfin Smelt, and Reservoir Fishes on the Sacramento River System.

Alternative	Potential Change	Consideration for Mitigation Measures
	Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.	
Alternative 5	**Trinity River Region** Coho Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Steelhead, and Green Sturgeon Effects would be similar. Reservoir Fishes Effects would be similar. Pacific Lamprey Effects would be similar. Eulachon Effects would be similar. **Sacramento River System** Winter-run Chinook Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Late Fall-run Chinook Salmon, Steelhead, Green Sturgeon, and White Sturgeon Effects would be similar. Delta Smelt, Longfin Smelt, and Sacramento Splittail Effects would be similar. Reservoir Fishes Effects would be similar. Pacific Lamprey and Other Species Effects would be similar. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The analysis of temperatures indicates somewhat higher temperatures and a higher likelihood of exceedance of suitable temperatures for spawning, and lower likelihood of exceeding suitable temperature for rearing of fall-run Chinook Salmon. The effect of higher temperatures is reflected in the slightly higher overall mortality of fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for fall-run Chinook Salmon in the Stanislaus River. The frequency of exceedance of temperature thresholds for steelhead smoltification and rearing would be more stressful. However, with higher flows in April and May and lower temperatures in April and May could benefit steelhead spawning. Fish passage would reduce the temperatures effects. White Sturgeon	Coordination of CVP and SWP operations with USFWS and NMFS to reduce impacts on Striped Bass and Hardhead on the Stanislaus River and San Joaquin River systems.

Alternative	Potential Change	Consideration for Mitigation Measures
	While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon. Reservoir Fishes While the analyses suggest that the effects could be more adverse, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. Other Species Given the similar or higher flows and similar or higher temperatures during their spawning and incubation period, it is likely that the potential to affect lamprey species in the Stanislaus and San Joaquin rivers would be greater. Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar or higher flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be somewhat more adverse. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected.	
Terrestrial Biological Resources		
Alternative 1	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Reduced floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased salt water habitat in the western Delta in the fall months of wet and above normal water years could adversely affect species that have acclimated to freshwater conditions.	Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce flow reduction impacts on the Stanislaus River. Implement program for gravel augmentation and mechanical modification of floodplain habitat along the lower Clear Creek to reduce floodplain impacts. Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce adverse impacts due to increased salinity in the western Delta in the fall months of wet and above normal water year types.

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 2	No effects on terrestrial resources.	None needed
Alternative 3	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Reduced floodplain habitat along lower Clear Creek. Similar or improved terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased salt water habitat in the western Delta in the fall months of wet and above normal water years could adversely affect species that have acclimated to freshwater conditions.	Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce flow reduction impacts on the Stanislaus River. Implement program for gravel augmentation and mechanical modification of floodplain habitat along the lower Clear Creek to reduce floodplain impacts. Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce adverse impacts due to increased salinity in the western Delta in the fall months of wet and above normal water year types.
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative; except for increased terrestrial vegetation along the riparian corridors related to recruitment of riparian vegetation.	Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce flow reduction impacts on the Stanislaus River. Implement program for gravel augmentation and mechanical modification of floodplain habitat along the lower Clear Creek to reduce floodplain impacts. Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce adverse impacts due to increased salinity in the western Delta in the fall months of wet and above normal water year types.
Alternative 5	Similar flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Increased flows along the Stanislaus River in the spring; therefore, could be improved terrestrial habitat conditions. Similar floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Similar freshwater and salt water habitats.	None needed.
Geology and Soils Resources		
Alternative 1	No effects on geology and soils resources.	None needed
Alternative 2	No effects on geology and soils resources.	None needed
Alternative 3	No effects on geology and soils resources.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 5	No effects on geology and soils resources.	None needed
Agricultural Resources		
Alternative 1	No effects on agricultural resources.	None needed
Alternative 2	No effects on agricultural resources.	None needed
Alternative 3	No effects on agricultural resources.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	No effects on agricultural resources.	None needed
Land Use		
Alternative 1	No effects on municipal and industrial land use.	None needed
Alternative 2	No effects on municipal and industrial land use.	None needed
Alternative 3	No effects on municipal and industrial land use.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	No effects on municipal and industrial land use.	None needed
Visual Resources		
Alternative 1	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be increased by 6 percent in wet and critical dry years at San Luis Reservoir, by 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions.	None needed
Alternative 2	No effects on visual resources.	None needed
Alternative 3	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be increased by 8 percent in wet years and 6 percent in above normal years at San Luis Reservoir, by 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions.	None needed
Recreation Resources		
Alternative 1	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be increased by 6 percent in wet and critical dry years at San Luis Reservoir, by 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern	Changes in CVP and SWP operations to reduce impacts on recreational opportunities in the rivers.

Alternative	Potential Change	Consideration for Mitigation Measures
	California regions. Recreational resources similar on Trinity River; improved on the Sacramento River downstream of Keswick Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam depending upon the month.	
Alternative 2	No effects on recreational resources.	None needed
Alternative 3	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be increased by 8 percent in wet years and 6 percent in above normal years at San Luis Reservoir, by 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions. Recreational resources similar on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, and the Stanislaus River downstream of Goodwin Dam depending upon the month. Recreational opportunities related to Striped Bass fishing would be reduced.	Changes in CVP and SWP operations to reduce impacts on recreational opportunities in the rivers. No mitigation measures available to reduce impacts to reduction in Striped Bass fishing opportunities.
Alternative 4	Reservoir and flow-related recreational opportunities would be as described for Alternative 1 compared to the No Action Alternative. Recreational opportunities related to Striped Bass fishing would be reduced.	Changes in CVP and SWP operations to reduce impacts on recreational opportunities in the rivers. No mitigation measures available to reduce impacts to reduction in Striped Bass fishing opportunities.
Alternative 5	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Recreational resources similar or improved on Trinity, Sacramento and American rivers; and both improved and reduced on the Feather and Stanislaus rivers.	Changes in CVP and SWP operations to reduce impacts on recreational opportunities in the rivers.
	Air Quality and Greenhouse Gas Emissions	
Alternative 1	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions.	None needed
Alternative 2	No effects on air quality.	None needed
Alternative 3	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 6 percent in the Central Valley,	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
	9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions.	
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.	None needed
	Cultural Resources	
Alternative 1	No effects on cultural resources.	None needed
Alternative 2	No effects on cultural resources.	None needed
Alternative 3	No effects on cultural resources.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	No effects on cultural resources.	None needed
	Public Health	
Alternative 1	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 7 percent increase at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.	None needed
Alternative 2	No effects on public health issues.	None needed
Alternative 3	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass throughout the Delta.	None needed
	Socioeconomics	
Alternative 1	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar (within 5 percent of existing values). M&I water supply costs would decrease by 10 percent in the Sacramento Valley and increase	None available to reduce increased M&I water supply costs in the Central Valley and Central Coast regions.

Alternative	Potential Change	Consideration for Mitigation Measures
	by 14 percent in the San Joaquin Valley. Recreational economic factors would increase related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 30 percent. Recreational economic factors would increase related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would increase by 6 percent. Recreational economic factors would increase related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 14 percent. Recreational economic factors would increase related to use of reservoirs that store SWP water.	
Alternative 2	No effects on socioeconomic factors.	None needed
Alternative 3	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 6 percent in the Sacramento Valley and by 21 percent in the San Joaquin Valley. Recreational economic factors related to Striped Bass would be reduced. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 21 percent. Recreational economic factors would increase related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would increase related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 14 percent. Recreational economic factors would be similar.	None available to reduce increased M&I water supply costs in the Central Valley Region
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative for non-recreational economic factors. Reduced recreational economic factors related to Striped Bass fishing.	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 5	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would be similar in the Sacramento and San Joaquin valleys. Recreational economic factors would be similar. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar.	None needed
	Indian Trust Assets	
Alternative 1	No effects on Indian Trust Assets.	None needed
Alternative 2	No effects on Indian Trust Assets.	None needed
Alternative 3	No effects on Indian Trust Assets.	None needed
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed
Alternative 5	No effects on Indian Trust Assets.	None needed
	Environmental Justice	
Alternative 1	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.	None needed
Alternative 2	No effects on environmental justice factors.	None needed
Alternative 3	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 6 percent in the Central Valley, 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions.	None needed
Alternative 4	Same effects as described for Alternative 1	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
	compared to the No Action Alternative.	
Alternative 5	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions. Similar mercury concentrations in Largemouth Bass throughout the Delta.	None needed

Table 3.7 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
	Surface Water Resources and Water Supplies	
No Action Alternative	**Trinity Lake** In wet years, below normal, and dry years, storage would be similar in all months. In above normal years, storage would be similar in January through October; and less in November and December (up to 5.7 percent). In critical dry years, storage would be less in all months (up to 10.3 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions (over the 82-year analysis period), flows would be similar in March through November; and reduced in December through February (up to 9.5 percent). In wet years, flows would be similar in April through November; and reduced in December through March (up to 11.2 percent). In dry years, flows would be similar all months. **Shasta Lake** In wet years, storage would be similar in October and December through August; and reduced in September and November (up to 8.2 percent). In above normal years, storage would be similar in January through September; and reduced in October through December (up to 7.5 percent). In below normal years, storage would be similar in March through September; and reduced in October through February (up to 10.5 percent). In dry years, storage would be similar in January through October; and reduced in November and December (up to 6.1 percent). In critical dry years, storage would be reduced under all months (up to 14.4 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; increased flows in September and November (up to 37.7 percent); and reduced flows in December,	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	January, and June (up to 7.8 percent). In wet years, similar flows would occur in January through July; increased flows in September through November (up to 77.7 percent); and reduced flows in December and August (up to 14.6 percent). In dry years, similar flows would occur in July through October, December through March, and May; increased flows in November (33.4 percent); and reduced flows in April and June (up to 7.3 percent). **Sacramento River at Freeport** Over long-term conditions, similar flows would occur in October, December through May, and August; increased flows in September, November, and July (up to 43.3 percent); and reduced flows in June (11.4 percent). In wet years, similar flows would occur in January through June and October; increased flows in July through September and November (up to 90.3 percent); and reduced flows in December (10.7 percent). In dry years, similar flows would occur in August through October and December through April; increased flows in November and July (up to 15.8 percent); and reduced flows in May and June (up to 11.9 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 17.9 percent). In above normal years, storage would be similar in February through August; and reduced in September through January (up to 13.2 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 17.7 percent). In dry years, storage would be similar in June; and reduced in all other months (up to 12.5 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and April; increased flows in July through September (up to 76.1 percent); and reduced flows in October, December through March, May, and June (up to 27.2 percent). In wet years, similar flows would occur in October through November and March through May; increased flows in July through September (up to 184 percent) and reduced flows in December through February (up to 26.0 percent). In dry years, similar flows would occur in November through March; increased flows in April and July (up to 52.4 percent); and reduced flows in August through October and May and June (up to 27.6 percent). **Folsom Lake** In wet years, storage would be similar in December	

Alternative	Potential Change	Consideration for Mitigation Measures
	through August; and reduced in September through November (up to 10.8 percent). In above normal years, storage would be similar in January through June, September, and October; reduced in November and December (up to 8.2 percent); and increased in July and August (up to 5.7 percent). In below normal years, storage would be similar in February through May; reduced in October through January (up to 11.9 percent); and increased in July through September (up to 17.1 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in October through June; and reduced in July through September (up to 10.8 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November through May and July; increased flows in September and October (up to 44.7 percent); and reduced flows in June and August (up to 6.1 percent). In wet years, similar flows would occur in October through November and January through July; increased flows in September (91.1 percent) and reduced flows in December and August (up to 10.7 percent). In dry years, similar flows would occur in all months except October, February and July; increased flows in October (16.5 percent); and reduced flows in February and July (up to 7.3 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and increased in May (40.7 percent). **New Melones Reservoir** In wet, below normal, and dry years, storage would be similar in all months. In above normal years, storage would be similar in all months except October when storage would be reduced by 5.7 percent. In critical dry years, storage would be similar in February, March, and July through September; and reduced in October through January and April through June (up to 6.9 percent). In all months, in all water year types, surface water elevations would be similar. Stanislaus River downstream of Goodwin Dam Over long-term conditions, similar flows would occur in May and July through September; increased flows in October, March, and April (up to 148.7 percent); and reduced flows in November through February and June (up to 33.8 percent). In wet years, similar flows would occur in February and April; increased flows in October, March, May, July, and August (up to 117.1 percent); and reduced flows in September, November through January, and June (up to 50.8 percent). In dry years, similar flows would occur in July through September; increased flows in October and April (up to 154.3 percent); and reduced flows in	

Alternative	Potential Change	Consideration for Mitigation Measures
	November through March, May, and June (up to 35.7 percent). San Joaquin River at Vernalis Over long-term conditions, similar flows would occur in July through September and November through May; increased flows in October (19 percent); and reduced flows in June (8 percent). In wet years, similar flows would occur in July through September and November through May; increased flows in October (16.8 percent); and reduced flows in June (9.4 percent). In dry years, similar flows would occur in November through March and May through September; and increased flows in October and April (up to 18.3 percent). **San Luis Reservoir** In wet years, storage would be similar in June and September; increased in March, July, and August (up to 9.6 percent); and reduced in October through February, April, and May (up to 57.2 percent). Surface water elevations would be less in all months (up to 10.7 percent). In above normal years, storage would be similar in July and September; increased in August (9.5 percent); and reduced in October through June (up to 71.2 percent). Surface water elevations would be less in all months (up to 13.0 percent). In below normal years, storage would be similar in July and September; increased in August (20.4 percent); and reduced in October through June (up to 67.1 percent). Surface water elevations would be less in all months (up to 16.0 percent). In dry years, storage would be similar in September; increased in July (34.2 percent); and reduced in October through June and August (up to 44.0 percent). Surface water elevations would be similar in September through January; and less in February through August (up to 10.4 percent). In critical dry years, storage would be similar in September; increased in July (60.2 percent); and reduced in August and October through June (up to 51.1 percent). Surface water elevations would be similar in October through January; and reduced in February through September (up to 9.7 percent). **Yolo Bypass** In wet years, flows into Yolo Bypass would be similar in January through September; increased in October (25 percent); and reduced in November and December (up to 14.8 percent). In above normal years, flows into Yolo Bypass would be similar in April through December; and reduced in January through March (up to 13.9 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and reduced in December through March (up to 25.3 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and reduced in December (5.9 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow**	

Alternative	Potential Change	Consideration for Mitigation Measures
	In wet years, average monthly Delta outflow in July through November, January, April, and May (up to 13,683 cfs); and decrease in December, February, March, and June (up to 1,590 cfs). In dry years, average monthly Delta outflow would be similar or increase in all months (up to 3,114 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows would be more positive in September through February, April, and May (up to 10,005 cfs); and more negative in March and June through August (up to 923 cfs). In dry years, average monthly OMR flows would be more positive in August through June (up to 3,489 cfs), and more negative in June (2,073 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 1,051 TAF (18 percent) less under the No Action Alternative as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be reduced by 16 percent over the long-term conditions; 31 percent in dry years; and 37 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be reduced by 6 percent over the long-term conditions; 8 percent in dry years; and 7 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be reduced by 24 percent over the long-term conditions; 33 percent in dry years; and 37 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be reduced by 10 percent over the long-term conditions; 9 percent in dry years; and 7 percent in critical dry years. Deliveries to the Eastside contractors would be similar under the long-term conditions and dry and critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be reduced by 18 percent over the long-term conditions; 18 percent in dry years; and 20 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be reduced by 18 percent over the long-term conditions; 19 percent in dry years; and 22 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be increased by 9 percent over the long-term conditions; 7 percent in dry years; and 9 percent in critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 83 percent over the long-term conditions; 96 percent in dry years; and 92 percent in critical dry years.	
Alternative 1	No effects on surface water resources or water supplies.	None needed.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 3	**Trinity Lake** Similar storage and surface water elevations in all months and all water year types. **Trinity River downstream of Lewiston Dam** Similar flows in all months for long-term conditions and wet and dry years. **Shasta Lake** Similar storage and surface water elevations in all months and all water year types. **Sacramento River at Keswick** Similar flows in all months for long-term conditions and wet and dry years. **Sacramento River at Freeport** Similar flows in all months for long-term conditions and wet years. In dry years, similar flows would occur in July through May; and increased flows in June (11 percent). **Lake Oroville** Similar storage and surface water elevations in all months and all water year types. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and January through June; reduced flows in October, December, and September (up to 12.5 percent); and increased flows in July and August (up to 17.0 percent). In wet years, similar flows would occur in November and January through May; reduced flows in October, December, and September (up to 14.6 percent); and increased flows in June through August (up to 10.9 percent). In dry years, similar flows would occur in November and January through June; reduced flows in August through October (up to 21.2 percent); and increased flows in July (37.1 percent). **Folsom Lake** Similar storage and surface water elevations in all months and all water year types. **American River downstream of Nimbus Dam** Similar flows in all months for long-term conditions and wet and dry years. **Clear Creek downstream of Whiskeytown Dam** Flows would be identical in all months. **New Melones Reservoir** In wet years, storage would be similar in March through May; and increased in June through February (up to 8.4 percent). In above normal years, storage would be increased in all months (up to 16.3 percent). In below normal years, storage would be increased in all months (up to 14.7 percent). In dry years, storage would be increased in all months (up to 19.6 percent). In critical dry years, storage would be increased in all months (up to 32.1 percent).	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, similar flows would occur in October, December, January, and March; reduced flows would occur in November, May, and June (up to 52.3 percent); and increased flows in February, April, July, and August through September (up to 26.8 percent). In wet years, similar flows would occur in October, November, January, and April; reduced flows in May and June (up to 44.8 percent); and increased flows in December, February, March, and July through September (up to 68.6 percent). In dry years, similar flows would occur in July through October; reduced flows in November through March and May through June (up to 36.0 percent); and increased flows in April (40.2 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in July through May; and reduced flows in June (11.8 percent). In wet years, similar flows would occur in September through January, March through May, and July; reduced flows in June (8.3 percent); and increased flows in August and February (6.2 percent). In dry years, similar flows would occur in July through March; reduced flows in May and June (up to 12.3 percent); and increased flows in April (6.6 percent). **San Luis Reservoir** In wet years, storage would be similar in July through November and March through May; and reduced in December through February and June (up to 15.7 percent). Surface water elevations would be similar in all months. In above normal years, storage would be similar in November; increased in August and September (up to 12.1 percent); and reduced in October and December through July (up to 21.7 percent). Surface water elevations would be similar in March through December; and reduced in January and February (up to 6.0 percent). In below normal years, storage would be similar in August and September; and reduced in October through July (up to 40.1 percent). Surface water elevations would be similar in all months. In dry years, storage would be reduced in January through September (up to 19.2 percent); and increased in October through December (up to 13.2 percent). Surface water elevations would be similar in all months. In critical dry years, storage would be reduced in October through August (up to 28.5 percent); and increased in September (7.6 percent). Surface water elevations would be similar September through January; and reduced in February through August (up to 7.4 percent). **Yolo Bypass** In wet years, flows into the Yolo Bypass would be similar in November through September; and	

Alternative	Potential Change	Consideration for Mitigation Measures
	reduced in October (5.6 percent). In above normal, below normal, dry, and critical dry years, flows into the Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in November through February and July through September (up to 2,546 cfs); and decrease in October and March through June (up to 1,127 cfs). In dry years, average monthly Delta outflow would increase in November through April, July and August (up to 3,391 cfs); and decrease October, May, and June (up to 373 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, flows would be more positive in September through February, April, and May (up to 5,528 cfs); and more negative in March and June through August (up to 1,453 cfs). In dry years, flows would be more positive in August through May (up to 3,249 cfs); and more negative flows in June and July (up to 1,345 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 326 TAF (6 percent) less under Alternative 3 as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be similar over the long-term conditions; and reduced by 11 percent in dry years and 19 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors (including American River CVP contractors) would be similar in long-term conditions and dry and critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be similar over the long-term conditions; and reduced by 10 percent in dry years and 20 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar in long-term conditions and dry and critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and increased by 11 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry years; and reduced by 10 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be similar over the long-term conditions and in dry years; and reduced by 11 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 62 percent over the long-term conditions; 80 percent in dry years; and 76 percent in critical dry years.	

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 4	No effects on surface water resources or water supplies.	None needed
Alternative 5	**Trinity Lake** In wet, below normal, and dry years, storage would be similar. In above normal years, storage would be similar in January through October; and reduced in November and December (up to 5.3 percent). In critical dry years, storage would be reduced in all months (up to 10.0 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions, flows would be similar in March through November and January; and reduced in December and February (up to 9.6 percent). In wet years, flows would be similar in January and April through November; and reduced in December, February, and March (up to 13.9 percent). In dry years, flows would be similar in all months. **Shasta Lake** In wet years, storage would be similar in October and December through August; and reduced in November and September (up to 8.1 percent). In above normal years, storage would be similar in February through September; and reduced in October through December (up to 7.5 percent). In below normal years, storage would be similar in March through September; and reduced in October through February (up to 9.9 percent). In dry years, storage would be similar in January through October; and reduced in November through December (up to 5.9 percent). In critical dry years, storage would be reduced in all months (up to 16.8 percent). In all months, in all water year types, surface water elevations are similar. **Sacramento River at Keswick** Over long-term conditions, flows would be similar in July, August, October, and February through April; reduced in December, January, May and June (up to 8.2 percent); and increased in September and November (up to 38.5 percent). In wet years, flows would be similar in January through July; reduced in December and August (up to 15.0 percent); and increased in September through November (up to 77.3 percent). In dry years, similar flows would occur in July through October and December through March; reduced in April through June (up to 10.1 percent); and increased flows in November (32.1 percent). **Sacramento River at Freeport** Over long-term conditions, flows would be similar in October and December through April; reduced in May and June (up to 11.5 percent); and increased in July through September and November (43.4 percent). In wet years, flows would be similar in October and January through June; reduced in December	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	(6.2 percent); and increased in July through September and November (up to 89.0 percent). In dry years, similar flows would occur in August through October and December through April; reduced in May and June (up to 13.6 percent); and increased flows in July and November (up to 19.3 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 18.1 percent). In above normal years, storage would be similar in March through August; and reduced in September through February (up to 14.0 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 17.1 percent). In dry years, storage would be similar in May and June; and reduced in July through April (up to 11.4 percent). In critical dry years, storage would be similar in all months. Surface water elevations would be similar in all months, in all years. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and April; reduced flows in October, December through March, May, and June (up to 27.7 percent); and increased flows in July through September (up to 76.2 percent). In wet years, similar flows would occur in October, November, March through May; reduced flows in December through February and June (up to 25.6 percent); and increased flows in July through September (up to 181.9 percent). In dry years, similar flows would occur in November through April; reduced flows in October, May, June, August, and September (up to 45.4 percent); and increased flows in July (60.4 percent). **Folsom Lake** In wet years, storage would be similar in December through July; and reduced in August through November (up to 7.4 percent). In above normal years, storage would be similar in January through June, August, and October; reduced in September, November, and December (up to 8.3 percent); and increased in July (5.4 percent). In below normal years, storage would be similar in February through May; reduced in August through January (up to 13.2 percent); and increased in June and July (up to 10.2 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in August and June; and reduced in July (8.0 percent). Surface water elevations would be similar in all months, in all years. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur	

Alternative	Potential Change	Consideration for Mitigation Measures
	in November through July; reduced flows in August (5.8 percent); and increased in September and October (42.4 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in December and August (up to 13.7 percent); and increased flows in September (88.2 percent). In dry years, similar flows would occur in November through September; and increased flows in October (16.7 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and increased in May (40.7 percent). **New Melones Reservoir** In wet years, storage would be reduced in all months (up to 9.3 percent). In above normal years, storage would be reduced in all months (up to 9.9 percent). In below normal years, storage would be reduced in all months (up to 13.1 percent). In dry years, storage would be reduced in all months (up to 14.3 percent). In critical dry years, storage would be reduced in all months (up to 23.2 percent). Surface water elevations would be similar in all months, in all water year types. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, similar flows would occur in August; reduced flows would occur in November through February, June, July, August, and September (up to 35.8 percent); and increased flows in October and March through May (up to 144.8 percent). In wet years, similar flows would occur in February and April; reduced flows in November through January and June through September (up to 52.8 percent); and increased flows in October and March (up to 113.1 percent). In dry years, similar flows would occur in July through September; reduced flows in November through March and June (up to 35.7 percent); and increased flows in October, April, and May (150.1 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in November through March, May, and July through September; reduced flows in June (8.2 percent); increased flows in October and April (18.7 percent). In wet years, similar flows would occur in November through May and July through September; reduced flows in June (9.8 percent); and increased flows in October (16.2 percent). In dry years, similar flows would occur in November through March and June through September; and increased flows in October, April, and May (up to 24.5 percent). **San Luis Reservoir** In wet years, storage would be reduced in all months (up to 48.9 percent). Surface water elevations would be similar in September and March; and	

Alternative	Potential Change	Consideration for Mitigation Measures
	reduced in October through February and April through August (up to 9.9 percent). In above normal years, storage would be reduced in all months (up to 59.3 percent). Surface water elevations would be similar in September; and reduced in October through August (up to 12.9 percent). In below normal years, storage would be reduced in all months (up to 70.0 percent). Surface water elevations would be similar in September; and reduced in October through August (up to 16.7 percent). In dry years, storage would be reduced in all months (up to 51.4 percent). Surface water elevations would be similar in October through December; and reduced in January through September (up to 13.9 percent). In critical dry years, storage would be reduced in all months (46.3 percent). Surface water elevations would be reduced in all months (up to 13.5 percent). **Yolo Bypass** In wet years, flows would be similar in February through September; reduced flows in November through January (up to 15.0 percent); and increased in October (15.8 percent). In above normal years, flows would be similar in April through December; and reduced flows in January through March (up to 14.8 percent). In below normal years, flows would be similar in April through November; and reduced flows in December through March (up to 24.0 percent). In dry years, flows would be similar in January through November; and reduced flows in December (up to 7.4 percent). In critical dry years, flows would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would be increased in July through November, January, and April and May (up to 13,666 cfs); and reduced in December, February, March, and June (up to 1,713 cfs). In dry years, average monthly Delta outflow would be increased in July through May (up to 3,384 cfs); and reduced in June (526 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, OMR flows would be more positive in September through February, April and May (up to 10,017 cfs); and more negative in March and June through August (up to 964 cfs). In dry years, OMR flows would be more positive in September through June (up to 4,724 cfs); and more negative in July and August (up to 2,620 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 1,096 TAF (19 percent) less under Alternative 5 as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be reduced by 16 percent over the long-term conditions, 31 percent in dry years, and 36 percent in critical dry years.	

Alternative	Potential Change	Consideration for Mitigation Measures
	Deliveries to CVP North of Delta M&I contractors would be similar in long-term conditions and dry and critical dry years; however American River Contractors would be reduced by 7 percent over the long-term conditions; 8 percent in dry years; and 8 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be reduced by 25 percent over the long-term conditions, 35 percent in dry years and 38 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be reduced by 10 percent in long-term conditions, 9 percent in dry years, and 8 percent in critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and reduced by 11 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be reduced by 19 percent over the long-term conditions, 18 percent in dry years, and 21 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be reduced by 19 percent over the long-term conditions, 20 percent in dry years, and 23 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be increased by 13 percent over the long-term conditions, 11 percent in dry years, and 15 percent in critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 85 percent over the long-term conditions, 95 percent in dry years, and 95 percent in critical dry years.	
Surface Water Quality		
No Action Alternative	Salinity increases near Emmaton in July through March (5 to 125 percent depending upon water year type); decreases in June (5 to 29 percent); and is similar in April and May. Salinity increases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 65 percent) in September through January; and is similar or decreases (5 to over 30 percent) in spring and summer months. Salinity increases near Port Chicago in January through March (5 to 50 percent); and is similar in June through August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	Not considered for this comparison.
Alternative 1	No effects on public health issues.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Salinity increases near Emmaton in January through March and July through September (5 to 32 percent); decreases in June (5 to 26 percent);	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	and is similar in October through December, April, and May. Salinity decreases near Jones and Banks Pumping Plants in January through May (5 to 18 percent); and is similar in remaining months. Salinity increases near the Contra Costa Water District and Antioch intakes (5 to 30 percent) in January and February; and is similar or decreases (5 to over 10 percent) in remaining months. Salinity increases near Port Chicago in January through March (5 to 34 percent); and is similar in April through December. Similar mercury concentrations in Largemouth Bass throughout the Delta. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	
Alternative 4	No effects on public health issues.	Not considered for this comparison.
Alternative 5	Salinity increases near Emmaton in July through May (5 to 124 percent depending upon water year type); and decreases in June (5 to 29 percent). Salinity increases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 60 percent) in September through January or February; and decreases (5 to over 30 percent) in remaining months. Salinity increases near Port Chicago in September through May (5 to 50 percent); and is similar in June through August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.	Not considered for this comparison.
	Groundwater Resources	
No Action Alternative	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would increase by approximately 8 percent. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 200 feet in the Westside subbasin. The reduction in groundwater levels could cause additional land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	No effects on groundwater resources or water supplies.	None needed.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping, levels, and quality in the San Joaquin Valley would be similar. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and up to 100 feet in the Westside subbasin. **San Francisco Bay Area, Central Coast, and Southern California Regions** Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.	Not considered for this comparison.
Alternative 4	No effects on groundwater resources or water supplies.	None needed
Alternative 5	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would increase by approximately 8 percent. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 100 feet in the Delta-Mendota and Tulare Lake subbasins; up to 200 feet in the Kern County subbasins; and up to 500 feet in the Westside subbasin. The reduction in groundwater levels could cause additional land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.	Not considered for this comparison.
Energy Resources		
No Action Alternative	CVP annual net generation would be similar. SWP annual net generation would be reduced by 29 percent over the long-term condition; and by 37 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.
Alternative 1	No effects on energy resources.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	CVP annual net generation would be similar. SWP annual net generation would be reduced by 10 percent over the long-term condition; and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.
Alternative 4	No effects on energy resources.	Not considered for this comparison.
Alternative 5	CVP annual net generation would be similar. SWP annual net generation would be reduced by 30 percent over the long-term condition; and by 39 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.
Fish and Aquatic Resources		
No Action Alternative	**Trinity River Region** Coho Salmon Overall, the temperature model outputs for each of the Coho Salmon life stages suggest that the temperature of water released at Lewiston Dam generally would be similar, although the exceedance of water temperature thresholds would be slightly more frequent (1 percent). Given the similarity of the results and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), there would be similar effects on the Coho Salmon population in the Trinity River. Spring-run Chinook Salmon Overall, water temperature could have adverse effects on spring-run Chinook Salmon in the Trinity River; however, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Thus, given these relatively minor changes in temperature and temperature threshold exceedance, and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), likely to have similar effects on the spring-run Chinook Salmon population in the Trinity River. Fall-run Chinook Salmon Although the combined analysis based on water temperature suggests that operations could be slightly more adverse, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in water temperatures (as well as egg mortality). Overall, given these small differences and the inherent uncertainty in the temperature model, likely to have similar effects on the fall-run Chinook Salmon population in the Trinity River. Steelhead Although the water temperature and flow changes could have adverse effects on steelhead in the Trinity River, these effects would not occur in every	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures under the No Action Alternative as compared to the Second Basis of Comparison. Overall, the likely to result in similar effects on the steelhead population in the Trinity River. Green Sturgeon Overall, given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. Reservoir Fishes Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar. Pacific Lamprey Given the somewhat reduced flows and similar temperatures, it is likely that the effects would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon Given that the highest reductions in flow would be less than 10 percent in the Trinity River, which would represent even a smaller proportion in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River are unlikely to be affected by changes upstream at Lewiston Dam, it is likely the conditions would be similar for Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon The model results suggest that effects on winter-run Chinook Salmon would be similar, with a small likelihood that winter-run Chinook Salmon escapement would be higher. This potential distinction between the two scenarios, however, may be increased by the benefits of implementation of fish passage. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower under the No Action Alternative. This potential distinction may be offset by the benefits of implementation of fish passage. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly more adverse with a small likelihood that fall-run Chinook Salmon production would be lower. This potential distinction may be offset by the benefits of implementation of fish passage on the Sacramento and American rivers. Late Fall-run Chinook Salmon The model results suggest that overall, effects on late fall-run Chinook Salmon could be slightly more adverse with a small likelihood that late fall-run Chinook Salmon production would be lower. This potential distinction may be offset by the benefits of	

Alternative	Potential Change	Consideration for Mitigation Measures
	implementation of fish passage. <u>Steelhead</u> The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather River. This potential distinction may be offset by the benefits of implementation of fish passage on the Sacramento and American rivers. <u>Green Sturgeon</u> Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on Green Sturgeon in the Sacramento and Feather rivers. <u>White Sturgeon</u> Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on White Sturgeon in the Sacramento River. <u>Delta Smelt</u> Overall, likely would result in better conditions for Delta Smelt, primarily due to lower percentage entrainment for larval and juvenile life stages, and more favorable location of Fall X2 in wetter years, and on average. <u>Longfin Smelt</u> Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be less. <u>Sacramento Splittail</u> Overall, the slight adverse effects related to spawning habitat for Sacramento Splittail because of the decreased area of potential habitat (inundation) and the potential for a slight decrease in the frequency of inundation. <u>Reservoir Fishes</u> The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar or slightly higher. Overall, the results of the nest survival analysis suggest that conditions in the reservoirs would be more likely to support self-sustaining populations of black bass. <u>Pacific Lamprey</u> Based on the somewhat reduced flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). <u>Striped Bass, American Shad, and Hardhead</u> In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly decreased flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions	

Alternative	Potential Change	Consideration for Mitigation Measures
	for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** <u>Fall-run Chinook Salmon</u> Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain and it likely that the effects on fall-run Chinook Salmon in the Stanislaus River would be similar. Implementation of a fish passage project, likely would provide some benefit to fall-run Chinook Salmon if volitional passage were provided and additional habitat could be accessed. <u>Steelhead</u> Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the magnitude and frequency of exceedance of suitable temperatures for the various life stages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. Implementation of a fish passage project, likely would provide some benefit to steelhead. <u>Reservoir Fishes</u> Overall, the potential for adverse effects on reservoir fishes could slightly higher because of the overall relative reductions in reservoir storage and the slightly improved nest survival in some months. <u>Other Species</u> In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** <u>Killer Whale</u> Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.	
Alternative 1	No effects on aquatic resources.	Not considered for this comparison.
Alternative 2	**Trinity River Region** <u>The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison.</u> **Sacramento River System** <u>Winter-run Chinook Salmon</u> The model results suggest that effects on winter-run Chinook Salmon would be similar, with a small	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	likelihood that winter-run Chinook Salmon escapement would be higher. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower under the No Action Alternative. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly more adverse with a small likelihood that fall-run Chinook Salmon production would be lower. Late Fall-run Chinook Salmon The model results suggest that overall, effects on late fall-run Chinook Salmon could be slightly more adverse with a small likelihood that late fall-run Chinook Salmon production would be lower. Steelhead The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather River. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, Striped Bass, American Shad, and Hardhead The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain and it likely that the effects on fall-run Chinook Salmon in the Stanislaus River would be similar. Steelhead Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the magnitude and frequency of exceedance of suitable temperatures for the various life stages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. Reservoir Fishes and Other Species The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison. **Pacific Ocean** Killer Whale The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison.	

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 3	**Trinity River Region** Coho Salmon and Spring-run Chinook Salmon Although the water temperature and flow changes could have slight beneficial effects, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Overall, likely to result in similar effects on the spring-run Chinook Salmon population in the Trinity River. Fall-run Chinook Salmon Although the water temperature and flow changes suggest a lower potential for adverse effects on fall-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. Steelhead Water temperatures suggest similar effects on the steelhead population. Green Sturgeon Water temperatures suggest similar effects on Green Sturgeon in the Trinity River or lower Klamath River and estuary. Reservoir Fishes Overall, reservoir storage and nest survival suggest similar effects on black bass. Pacific Lamprey Overall, it is likely that effects on Pacific Lamprey would be similar. This conclusion likely also applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon It is likely that effects would have a similar potential to influence Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon Potentially slightly more beneficial due to lack of fish passage, if fish passage is successful in providing access to higher quality habitat, The predator control measures could reduce winter-run Chinook Salmon mortality. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower. The ocean harvest restriction component and predator control measures could reduce spring-run Chinook Salmon mortality. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. However, the potential for salvage loss also would be higher. The ocean harvest restriction component and	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	predator control measures could reduce fall-run Chinook Salmon mortality. Overall, effects on fall-run Chinook Salmon would be slightly less adverse. <u>Late Fall-run Chinook Salmon</u> Overall, it is likely that the effects on late fall-run Chinook Salmon would be similar. The ocean harvest restriction component and predator control measures could reduce late fall-run Chinook Salmon mortality. <u>Steelhead</u> The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather and American rivers. The ocean harvest restriction component and predator control measures could reduce steelhead mortality. <u>Green Sturgeon</u> Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model, the slightly reduced frequency of exceedance of temperature thresholds could result in beneficial effects on sturgeon. <u>White Sturgeon</u> Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model, the slightly reduced frequency of exceedance of temperature thresholds could result in beneficial effects on sturgeon. <u>Delta Smelt</u> Overall, effects would be similar based on reduced entrainment and more favorable location of Fall X2. <u>Longfin Smelt</u> Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, potential beneficial effects likely would be greater. <u>Sacramento Splittail</u> Flows entering the Yolo Bypass generally would be somewhat lower. This could provide somewhat lower value to Sacramento Splittail because of the decreased area of potential spawning habitat. <u>Reservoir Fishes</u> The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar. Thus, it is likely that effects on black bass would be similar. <u>Pacific Lamprey</u> Pacific Lamprey would be subjected to the same temperature conditions described above for salmonids. Based on the somewhat increased flows and slightly decreased temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a slightly lower potential to adversely affect Pacific Lamprey in the Sacramento, Feather, and American rivers. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey).	

Alternative	Potential Change	Consideration for Mitigation Measures
	<u>Other Species</u> Changes in average monthly water temperature would be small. In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Given the somewhat increased flows and decreased water temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a lower potential to adversely affect Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** <u>Fall-run Chinook Salmon</u> Overall, likely would have similar effects on the fall-run Chinook Salmon population in the San Joaquin River watershed. Beneficial effects to juvenile fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions under fall-run Chinook Salmon would benefit the fall-run Chinook Salmon population. <u>Steelhead</u> Given the frequency of exceedance under both Alternative 3 and the Second Basis of Comparison, water temperature conditions for steelhead in the Stanislaus River would be generally similar. Additional beneficial effects to juvenile steelhead as a result of trap and haul passage across through the Delta. It remains uncertain, however, if predator management actions would benefit steelhead. <u>White Sturgeon</u> While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon. <u>Reservoir Fishes</u> While the analyses suggest that the effects could be more favorable, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. <u>Other Species</u> In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the slightly lower flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers	

Alternative	Potential Change	Consideration for Mitigation Measures
	would be similar. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected.	
Alternative 4	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon The effects would be identical. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects in the Sacramento River system would be similar. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, American Shad, and Hardhead The effects in the Sacramento River system would be identical. Striped Bass The effects in the Sacramento River system would be similar. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The effects in the Stanislaus River/Lower San Joaquin River system would be similar. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. White Sturgeon, Reservoir Fishes, and Other Species The effects in the Stanislaus River/Lower San Joaquin River system would be identical. Striped Bass The effects in the Stanislaus River/Lower San Joaquin River system would be similar. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.	
Alternative 5	**Trinity River Region** Coho Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Steelhead, and Green Sturgeon Monthly water temperature generally would be similar (less than 0.5ºF differences), with the exception of drier years when temperatures could be as much as 2.2ºF cooler in November and 1.5ºF in December. Average monthly water temperatures could be slightly (up to 0.6ºF) higher during July and August and lower (up to 0.7ºF) in September. Lower September temperatures may result in slightly better conditions for spring-run Chinook Salmon spawning. Similarly, temperature conditions could be slightly better for fall-run Chinook Salmon spawning because of the reduced temperatures in November during critical dry years. Water temperature thresholds for Coho Salmon, fall-run Chinook Salmon, and steelhead would be exceeded slightly more frequently (less than 1 percent), whereas thresholds for spring-run Chinook Salmon would be exceeded less frequently (up to 4 percent) in August in September. These temperature results are reflected in the egg mortality results for fall-run Chinook Salmon, which indicate slightly higher mortality under Alternative 5 compared to the Second Basis of Comparison, with differences less than 0.3 percent in most year types and 1.9 percent in critical dry years. The minor changes in water temperatures and mortality suggest that conditions for Coho Salmon, fall-run Chinook Salmon, steelhead, and Green Sturgeon in the Trinity River would be similar. However, the reduced threshold exceedances for spring-run Chinook Salmon, although small, could be biologically meaningful under some conditions. Reservoir Fishes Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar. Pacific Lamprey It is likely that the effects would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon It is likely the conditions would be similar for Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds. This is reflected in the slightly lower survival of winter-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model. Flow changes would have small effects on the availability of spawning and rearing habitat for winter-run Chinook Salmon as indicated by the decrease in flow (habitat)-related mortality predicted	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	by SALMOD. Through Delta survival of juvenile winter-run Chinook Salmon would be similar as indicated by the DPM results; and the OBAN results suggest that Delta survival could be higher. Entrainment may also be reduced as indicated by the OMR flow analysis. Median adult escapement to the Sacramento River would be reduced slightly as indicated by the IOS model results which incorporate temperature, flow, and mortality effects on each life stage over the entire life cycle of winter-run Chinook Salmon. However, the OBAN model results indicate an increase in escapement over a more limited time period (1971 to 2002). Considering all the above analyses for the winter-run Chinook Salmon population, the changes in overall effects are highly uncertain. However, the upstream fish passage could benefit the winter-run Chinook Salmon population in the Sacramento River. <u>Spring-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. There would be little change in flows or temperatures in Clear Creek. The effect of increased temperatures is reflected in the slightly lower overall survival of spring-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for spring-run in the Sacramento River. In drier years, the likelihood of adverse temperature effects would be increased. Flow changes would likely have small effects on the availability of spawning and rearing habitat for spring-run Chinook Salmon in the Sacramento River as indicated by the decrease in flow (habitat)-related mortality predicted by SALMOD. Through Delta survival of juvenile spring-run Chinook Salmon would be similar as indicated by the DPM results, and entrainment could be reduced as indicated by the salvage analysis. Overall, similar or somewhat greater adverse effects on the spring-run Chinook Salmon population in the Sacramento River watershed, particularly in drier water year types. However, given that most of the spring-run Chinook Salmon are on the tributaries where the effects of changes are minimal and with the fish passage actions, it is likely that the effects would be similar or beneficial. <u>Fall-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. There would be little change in flows or temperatures in Clear Creek, but these differences might not be biologically meaningful because the temperature outputs represent conditions at Igo, a location upstream of most fall-run Chinook Salmon spawning and rearing. The effect of increased temperatures is reflected in the slightly lower overall survival of fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for fall-run in the Feather and American rivers. In drier years, the likelihood of adverse temperature effects would be increased. Flow changes would likely have small effects on the availability of spawning and rearing habitat for fall-run Chinook Salmon in the Sacramento River as	

Alternative	Potential Change	Consideration for Mitigation Measures
	indicated by the slight decrease in spawning WUA in the Sacramento and Feather Rivers and slight increases in spawning WUA for fall-run Chinook Salmon in the American River. Fry and juvenile rearing WUA would be increased slightly in the Sacramento River and this is reflected in a decrease in flow (habitat)-related mortality predicted by SALMOD. Through-Delta survival of juvenile fall-run Chinook Salmon would be similar as indicated by the DPM results, and entrainment could be reduced as indicated by the OMR flow analysis. Overall, effects likely to be similar or slightly greater adverse effects on the fall-run Chinook Salmon population in the Sacramento River watershed, particularly in drier water year types. Fish passage actions could result in beneficial effects. <u>Late Fall-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds. This is reflected in the slightly lower survival of late fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model. Flow changes would have small effects on the availability of spawning habitat for late fall-run Chinook Salmon as indicated by the WUA analysis. Fry rearing habitat would be slightly increased, but juvenile rearing WUA would decrease during some months. These effects are reflected in the decrease in flow (habitat)-related and the increase in temperature-related egg and fry mortality predicted by SALMOD. Juvenile rearing mortality is also predicted to increase. Through Delta survival of juvenile late fall-run Chinook Salmon would be increased as indicated by the DPM results, and entrainment may be reduced as indicated by the OMR flow analysis. Overall, likely to have lesser adverse effects on the late fall-run Chinook Salmon population in the Sacramento River. Fish passage actions would increase the beneficial effects. <u>Steelhead</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. In drier years, the likelihood of adverse temperature effects would be increased. There would be little change in flows or temperatures in Clear Creek. Overall, likely to have somewhat greater adverse effects on the steelhead population in the Sacramento River watershed, particularly in drier water year types because of the temperature effects. Fish passage could provide additional benefit for steelhead. <u>Green Sturgeon</u> Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on Green Sturgeon in the Sacramento and Feather rivers. <u>White Sturgeon</u> Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on White Sturgeon in the	

Alternative	Potential Change	Consideration for Mitigation Measures
	Sacramento River. Delta Smelt Overall, likely would result in better conditions for Delta Smelt, primarily due to lower percentage entrainment for larval and juvenile life stages, and more favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be less. Sacramento Splittail Overall, the slight adverse effects related to spawning habitat for Sacramento Splittail because of the decreased area of potential habitat (inundation) and the potential for a slight decrease in the frequency of inundation. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar or slightly higher. Overall, the results of the nest survival analysis suggest that conditions in the reservoirs would be more likely to support self-sustaining populations of black bass. Pacific Lamprey Based on the somewhat reduced flows and increased temperatures during their spawning and incubation period, it is likely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers be more adverse. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). Striped Bass, American Shad, and Hardhead In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly decreased flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon The analysis of temperatures indicates lower temperatures and a lesser likelihood of exceedance of suitable temperatures for spawning and rearing of fall-run Chinook Salmon in the Stanislaus River below Goodwin Dam and in the San Joaquin River at Vernalis. The effect of lower temperatures is reflected in the slightly lower overall mortality of fall-run Chinook Salmon eggs predicted by Reclamation's salmon survival model for fall-run in the Stanislaus River. As described above, the instream flow patterns are anticipated to benefit fall-run Chinook Salmon in the Stanislaus River and downstream in the lower San Joaquin River below	

Alternative	Potential Change	Consideration for Mitigation Measures
	Vernalis. Overall, would have less adverse effect on the fall-run Chinook Salmon population in the San Joaquin River watershed. <u>Steelhead</u> Given the frequency of exceedance and the generally stressful temperature conditions in the river, the substantial lower temperatures in October and April suggest that there would be less potential to adversely affect steelhead. <u>Reservoir Fishes</u> Overall, the potential for adverse effects on reservoir fishes could slightly higher because of the overall relative reductions in reservoir storage and the slightly reduced nest survival in some months. <u>Other Species</u> In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** <u>Killer Whale</u> Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.	
Terrestrial Biological Resources		
No Action Alternative	Similar or increased flows along Trinity, Sacramento, American, and Stanislaus rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Feather River in the spring; therefore, could be reduced terrestrial habitat conditions. Improved floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased freshwater habitat in the western Delta.	Not considered for this comparison.
Alternative 1	No effects on terrestrial resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Similar habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Similar freshwater and salt water habitats.	Not considered for this comparison.
Alternative 4	Similar effects except for increased terrestrial vegetation along the riparian corridors related to	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	recruitment of riparian vegetation.	
Alternative 5	Similar or increased flows along Trinity, American, and Stanislaus rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Sacramento and Feather rivers in the spring; therefore, could be reduced terrestrial habitat conditions. Improved floodplain habitat along lower Clear Creek. Similar or decreased terrestrial conditions in Yolo Bypass related to similar or lower water that flows from the Sacramento River at the Fremont Weir. Increased freshwater habitat in the western Delta.	Not considered for this comparison.
Geology and Soils Resources		
No Action Alternative	No effects on geology or soils resources.	Not considered for this comparison.
Alternative 1	No effects on geology or soils resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	No effects on geology or soils resources.	Not considered for this comparison.
Alternative 4	No effects on geology or soils resources.	Not considered for this comparison.
Alternative 5	No effects on geology or soils resources.	Not considered for this comparison.
Agricultural Resources		
No Action Alternative	No effects on agricultural resources.	Not considered for this comparison.
Alternative 1	No effects on agricultural resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	No effects on agricultural resources.	Not considered for this comparison.
Alternative 4	No effects on agricultural resources.	Not considered for this comparison.
Alternative 5	No effects on agricultural resources.	Not considered for this comparison.
Land Use		
No Action Alternative	No effects on municipal and industrial land use.	Not considered for this comparison.
Alternative 1	No effects on municipal and industrial land use.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	No effects on municipal and industrial land use.	Not considered for this comparison.
Alternative 4	No effects on municipal and industrial land use.	Not considered for this comparison.
Alternative 5	No effects on municipal and industrial land use.	Not considered for this

Alternative	Potential Change	Consideration for Mitigation Measures
		comparison.
	Visual Resources	
No Action Alternative	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be reduced by 6 percent in wet and critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.
Alternative 1	No effects on visual resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions.	Not considered for this comparison.
Alternative 4	No effects on visual resources.	Not considered for this comparison.
Alternative 5	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be reduced by 6 percent in dry years and 9 percent in critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.
	Recreation Resources	
No Action Alternative	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be reduced by 6 percent in wet and critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Recreational resources similar on Trinity River; reduced on the Sacramento River downstream of Keswick Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam depending upon the month.	Not considered for this comparison.
Alternative 1	No effects on recreational resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Recreational resources similar on Trinity River, Sacramento, Feather, and American rivers; and both improved and reduced on the Stanislaus River depending upon the month. Recreational opportunities related to Striped Bass fishing would be reduced.	
Alternative 4	Reservoir and flow-related recreational opportunities would be similar. Recreational opportunities related to Striped Bass fishing would be reduced.	Not considered for this comparison.
Alternative 5	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be reduced by 6 percent in dry years and 9 percent in critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Recreational resources similar or improved on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, and the Stanislaus River downstream of Goodwin Dam depending upon the month.	Not considered for this comparison.
Air Quality and Greenhouse Gas Emissions		
No Action Alternative	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.
Alternative 1	No effects on air quality.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.	Not considered for this comparison.
Alternative 4	No effects on air quality.	Not considered for this comparison.
Alternative 5	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
Cultural Resources		
No Action Alternative	No effects on cultural resources.	Not considered for this comparison.
Alternative 1	No effects on cultural resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	No effects on cultural resources.	Not considered for this comparison.
Alternative 4	No effects on cultural resources.	Not considered for this comparison.
Alternative 5	No effects on cultural resources.	Not considered for this comparison.
Public Health		
No Action Alternative	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 6 percent decrease at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.	Not considered for this comparison.
Alternative 1	No effects on public health issues.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass throughout the Delta.	Not considered for this comparison.
Alternative 4	No effects on public health issues.	Not considered for this comparison.
Alternative 5	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 9 percent decrease at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.	Not considered for this comparison.
Socioeconomics		
No Action Alternative	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 11 percent in the Sacramento Valley and decrease by 12 percent in the San Joaquin Valley. Recreational economic factors would decrease	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 44 percent. Recreational economic factors would decrease related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 6 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 17 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water.	
Alternative 1	No effects on socioeconomic factors.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would be similar in the Sacramento Valley and by 6 percent in the San Joaquin Valley. Recreational economic factors related to Striped Bass would be reduced. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 13 percent. Recreational economic factors would be similar. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 14 percent. Recreational economic factors would be similar.	Not considered for this comparison.
Alternative 4	No effects on non-recreational socioeconomic factors. Reduced recreational economic factors related to Striped Bass fishing.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 5	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 11 percent in the Sacramento Valley and decrease by 14 percent in the San Joaquin Valley. Recreational economic factors would decrease related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 46 percent. Recreational economic factors would decrease related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 6 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 20 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water.	Not considered for this comparison.
	Indian Trust Assets	
No Action Alternative	No effects on Indian Trust Assets.	Not considered for this comparison.
Alternative 1	No effects on Indian Trust Assets.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	No effects on Indian Trust Assets.	Not considered for this comparison.
Alternative 4	No effects on Indian Trust Assets.	Not considered for this comparison.
Alternative 5	No effects on Indian Trust Assets.	Not considered for this comparison.
	Environmental Justice	
No Action Alternative	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
	conditions.	
Alternative 1	No effects on environmental justice factors.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions. Similar mercury concentrations in Largemouth Bass throughout the Delta.	Not considered for this comparison.
Alternative 4	No effects on environmental justice factors.	Not considered for this comparison.
Alternative 5	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.	Not considered for this comparison.

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